

HOME ORCHARD

HOME ORCHARD DISEASE AND PEST MANAGEMENT GUIDE PREFACE

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Home orchard disease and pest management guides suggest cultural and chemical control practices that offer a reasonable degree of protection from pests. Home orchardists should be aware that producing commercial quality, blemish-free fruit in Georgia's climate is difficult. During the growing season, the crop should be monitored at least weekly for any emerging pest problems. Fungicides and insecticides work best when pest levels are low. Recommendations attempt to time applications just before and through typical peaks in pest abundance. Fine tuning the time of application to what you see in your orchard will help minimize pest damage. To be effective, fungicides need to be applied before appearance of symptoms and/or just prior to and during weather conditions favorable for disease development. Many fruit diseases are favored by cool-to-mild periods with moderate-to-high amounts of rainfall and humidity. Pruning and removal of diseased and/or dead twigs and branches, raking and removal of leaves and debris, regular mowing around vines, trees or bushes, and disposing of rotten and/or diseased fruit, improves disease and insect control. Collectively these practices are referred to as sanitation. Sanitation, in combination with choosing disease-resistant cultivars and the as-needed use of chemicals, will optimize control.

Pest pressure in home orchards is often as high, or higher, than is experienced in commercial orchards. Edge effect—higher pest abundance where two different habitat types meet—is common in commercial orchards. In home orchards, all of the trees, bushes, or vines fall within the “border rows,” so pest pressure is frequently high.

Home garden pesticide labels, which should be retained on all pesticide containers, indicate on what crops that particular product may be used. Federal law clearly restricts the use of any pesticides to only the crops or sites listed on the package's label. Home garden pesticides for use on fruits must specifically list fruits, or cite individual fruits, such as apples, pears, or peaches. Pesticide labels are based on rigorous food, applicator, and environmental safety considerations, and they are legally binding. **Always read the pesticide label before application.**

Pesticide options for managing home orchard pests are modest. While many different trade-named products are available, there are relatively few active ingredients. The effectiveness of, and the range of pests controlled by, any product is determined by its active ingredient(s) and rate. Dose, the amount of product applied, is determined by two factors: the amount applied (tablespoons, fluid ounces, or ounces) and by the active ingredient's concentration. The amount of product applied is limited by the product label. Higher label dosages normally provide better control. Remember, by following the product label you are assured of using safe amounts. Sometimes different products containing the same active ingredients will have varying amounts of active ingredient.

General considerations for home orchard pesticide applicators include:

- Wear goggles or other eye protection to shield yourself from spray drift.
- Wear long sleeves, long trousers, a hat, and shoes.
- Remove and launder clothing worn while applying pesticides; launder these clothes separately from family laundry before reusing them.
- Always check for and follow the pre-harvest interval(s) listed on the pesticide container(s). If you are mixing more than one product, follow the longest listed pre-harvest interval.
- Many insecticides, and some fungicides, are toxic to honey bees as well as other pollinators. Do not spray during bloom unless the product label specifically recommends bloom sprays, and do not apply insecticides if bees are foraging on orchard weeds.
- Assume pesticides to be toxic to fish and other non-target organisms, do not apply to water or where runoff can occur.
- Keep pets and children away from treated areas. Consider alternatives to toxic pesticides when treating close to residences or if there is a risk for non-target exposure.
- Store pesticides securely and only in the original container.

HOME APPLE AND PEAR (POME FRUIT) DISEASE AND INSECT GUIDE

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APPLE AND PEAR DISEASES

Successful production of apples in Georgia is difficult and requires careful management. Diseases are threats not only to the apple fruit, but also to tree health. The most important disease threats are fire blight and the summer rots (black, white, and bitter rots). Secondary diseases that will sometimes be important include the leaf spots, powdery mildew, and, in the mountains and upper piedmont, scab. All of these diseases can be at least partially controlled by using preventative measures, starting with selecting the appropriate apple cultivars, and choosing a good site. Apple trees must be properly pruned, especially when young, to develop a strong open structure, and careful attention must be paid to fertilization. Dead wood should be pruned out as soon as seen or immediately after leaf fall. Annual dormant pruning or tree training should not begin until trees are fully dormant (mid-January in north Georgia). Rake and, either, physically remove or thoroughly grind fallen leaves and mummified fruit with a mulching mower after leaf fall. Conscientious removal of diseased fruit and wood is important in reducing disease pressure.

Many popular cultivars of European pears are next to impossible to grow in Georgia due to fire blight (see cultivar list at end of this section), but if appropriate cultivars are chosen, pears can be much easier to grow than apples. Besides fire blight, there are only a few minor pear diseases that may or may not need management.

Fire blight, caused by the bacterium *Erwinia amylovora*, is a native disease that may be a major problem on apples and pears in some years. The bacterium survives in the previous year's infected wood and enters the plant through the flowers. The antibiotic streptomycin is often used to prevent flower infections in susceptible cultivars in orchards with a history of fire blight, especially when the weather is wet and warm. Antibiotics need to be applied before rain and frequently as flowers open. Coppers also have some effect on bacteria, but are generally not used during bloom due to the potential for damage to the foliage and flowers. The bacterium moves from the infected flowers into the branches and can kill susceptible cultivars, especially young trees, in one season, in some cases even with antibiotic treatment. Therefore, choosing disease resistant cultivars of apples and pears is

the most important management recommendation for home growers to prevent fire blight damage (see cultivar list at end of this section). Moderately resistant cultivars may not need any bloom sprays if the proper cultural practices are followed. When the weather conditions are optimal for infection during bloom (68–70° F with rain and humidity), the partially resistant cultivars suffer branch blight called “strikes,” but the disease will probably not kill the tree.

Appropriate pruning, to open up the canopy and maintain tree health, and removal of diseased wood are important in preventing fire blight. Diseased wood should be removed by cutting 8–12 inches below the diseased tissue. Pruning tools can be dipped in disinfectant such as 10% bleach between cuts to prevent spread of the bacterium, especially when pruning is done when the disease is active in spring and early summer. The removed wood should be taken from the orchard and destroyed. Dormant copper sprays reduce winter survival of the pathogens. Excess vigor often increases susceptibility to fire blight and other diseases, so a balanced nutritional program is also important. There are many good publications available on growing healthy fruit trees.

Black rot, bitter rot, and white rot are all caused by fungi that survive the winter on dead wood and old fruit in the tree and on the ground. Good sanitation practices are very important in reducing the impacts of these diseases. Dead branches, including fire blight “strikes” should be pruned out and destroyed. All old fruit should be removed from the tree and from the ground at the end of the season. Diseased fruit should be picked and destroyed as soon as they appear so the disease does not spread to other fruit on the tree. There are some cultivars of apple that have some resistance to the summer rots as well as fire blight (see list at end of this section). Fungicides may be needed and should be applied early in the season.

Cedar-apple rust causes leaf spots on certain apple cultivars in some years if Eastern red cedar (*Juniperus virginiana*) trees are within approximately a quarter-mile. Removal of all cedar trees within that distance is generally impractical, so resistant cultivars are recommended (see cultivar list at end of this section). The fungus overwinters on the juniper, infecting the apple leaves during early leaf

development. Fungicides can be sprayed during bloom if there has been a history of the disease causing significant defoliation of leaves. A similar rust goes to pear fruit (Cedar-quince rust), and hawthorn and mayhaw shoots and fruit (Cedar-hawthorn rust). Management is similar to cedar-apple rust.

Sooty blotch and flyspeck may be the most common apple diseases in the Southeast, but the damage that they cause to the fruit is purely cosmetic and superficial. However, black, speckled, sooty looking fruit may not be pleasing to everyone. These diseases are more evident on yellow or green-fruited cultivars. Appropriate pruning for good air circulation in the canopy may be enough to manage these diseases. If needed, fungicides can be applied. Post-harvest washing of fruit in hot soapy water, followed by rinsing with clean water, will remove much of the sooty blotch and some flyspeck.

Scab, leaf spots, and powdery mildew are considered minor problems in Georgia home orchards, but may be a problem in certain years, on certain cultivars, or in certain parts of the state. Experience will tell. The cultural practices recommended for the previously mentioned diseases will also help with managing these diseases. Scab is considered a major problem on apples in the Northeast, but in Georgia it is a minor pest, most often seen in our mountain counties.

APPLE AND PEAR INSECT AND MITE PESTS

Codling moth, Oriental fruit moth, and tufted apple bud moth are key fruit-feeding caterpillars that regularly damage apples and pears grown in Georgia's upper piedmont and mountain counties. Pome fruit grown in lower piedmont areas south of I-20 from west Georgia east to Atlanta, and south of a line from Atlanta to Augusta down to the coastal plain, typically experience light to moderate pressure from codling moth, Oriental fruit moth, and tufted apple bud moth. Injury to pome fruit from this complex of caterpillars in Georgia's coastal plain counties is normally very light. Modern synthetic insecticides provide good control of codling moth, Oriental fruit moth, and tufted apple bud moth. Organic insecticides struggle to control these key fruit feeding pests. For home orchardists who want to minimize pesticide use, or grow fruit as close to organic as feasible, substitution of a few well-timed synthetic insecticides will often dramatically improve control of these pests. In-orchard pheromone traps may be used to determine when

moth flights begin for codling moth, Oriental fruit moth, and tufted apple bud moth. Developmental models for each of these pests that can accurately predict the timing of their life cycle in your orchard are available online. After the first two sprays for these pests, examine your fruit twice a week and apply insecticide as needed when injury is observed. If you are not able to monitor for caterpillar pests, spraying every 14 days should provide reliable control. The number of insecticide sprays required varies with the intensity of pest pressure, the home orchardist's willingness to accept minor or cosmetic injuries, and length of season, as later ripening varieties require more sprays.

San Jose scale is a serious, annual pest that can debilitate or kill apples or pears if not treated. Scale are small, hard-to-see, sap-feeding insects that feed by inserting their syringe-like mouthparts into stems and fruit. Scale disperse during their first nymphal or "crawler" stage. Only the crawlers and the adult males move about. A few days after hatching, scale crawlers settle down, insert their mouthparts into stems or fruits and develop a protective cover, or scale, which protects them in a turtle shell-like fashion. Scale species are well camouflaged. Apples and pears should be treated twice during the dormant season (from leaf drop to pre-pink) every year with horticultural oil. Oil concentrations of 1–3% are recommended. Reduce the rate of oil to 1% just after leaf drop and before bloom. Do not apply oil when temperatures are expected to be higher than 70°F or lower than 25°F within 24 hours. Do not use horticultural oils within 14 days of applying sulfur or sulfur-containing fungicides such as *captan*.

Fire ants are nuisance pests in orchards. Except for recently transplanted trees, which can be engulfed in mounds, fire ants do almost no direct harm to fruit trees. However, many home gardeners find it worthwhile to treat their orchards with fire ant baits annually. Ant baits provide the most effective control, but they work slowly, requiring 4-8 weeks to reduce ant numbers. Ants must be actively foraging for baits to work well. Apply ant baits on warm, sunny days in the spring and again 6-8 weeks before harvest when ants are active.

Plant bugs, stink bugs, and leaffooted bugs are referred to as sucking bugs because they feed by sucking liquefied cell contents through syringe-like mouthparts. While there are several native stink bugs found in the Southeast, a relatively new invasive species has also

shown up in Georgia. The Brown marmorated stink bug (*Halyomorpha halys*) is an exotic stink bug that can cause major damage to tree fruit, especially apples. The adults are approximately 5/8-inch long with a mottled brownish grey color. The next to last (4th) antennal segment has a white band and there are black and white bands on several of the abdominal segments. What is unique about brown marmorated stink bugs is that they commonly overwinter inside houses and other dwellings and emerge in early spring. Once they emerge from overwintering, they immediately move to feed on available hosts. Although they will feed on apples early in the season, they prefer to feed on the ripening fruit near harvest. Look for both the nymphs and adults feed on apples late in the season. Sucking bug feeding will sometimes cause early-season fruit drop, which is normally of no consequence, as trees set more fruitlets than an un-thinned tree can mature. Later in the season, one sees catfacing, a scarring or deformation of the fruit, gumming, and corking.

Sucking bug injury is typically more pronounced in dry years. Sprays targeting fruit feeding caterpillars provide a helpful degree of sucking bug suppression. Regular mowing in and around the orchard prevents broadleaf winter annuals from blooming, this will often reduce plant bug abundance. Removal or culling of fruit damaged or disfigured by sucking bugs is an easy way to improve fruit quality and fruit size.

Plum curculio is an important fruit-attacking pest of apples in Georgia. Plum curculio are small weevils, or snout beetles, which feed on and lay their eggs in developing fruit. Insecticides applied at petal fall and the two sprays that follow should provide good control in plum curculio infested apples. A second wave of adults usually emerge about 8 to 10 weeks later (late June or July) and will also feed on and damage fruit. The females create a crescent-shaped scar on the fruit after laying an egg. Monitoring fruit in the summer for these scars can help determine if summer management is necessary.

PEST	MATERIAL OR ACTION	COMMENTS
DORMANT SEASON—Fruit and vegetative buds still fully dormant (not yet swollen)		
Scale, Mites, and Aphids	<i>dormant and/or verdant horticultural oils</i> Bonide All Seasons Horticultural and Dormant Spray Oil Hi-Yield Dormant Spray SunSpray Ultra-Fine Pest Oil (verdant)	Horticultural oils applied 2 times during each dormant season should provide good suppression of scale. Dormant oil applications also suppress European red mites and aphids. Horticultural oil sprays may be made after 95% leaf drop in the late fall up to 30 days before silver tip. Horticultural oils can cause fruit finish injury and foliar injury, particularly when applied in warm to hot temperatures. Do not apply horticultural oils with or within 14 days of applying sulfur or sulfur-containing fungicides such as <i>captan</i> . Some horticultural oils are organic (OMRI-approved).
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes	Fire ants may be a nuisance when working in vineyards or orchards. Ant baits or stakes are effective, but slow-acting, taking some 8 weeks to work. Apply baits in the spring and again 6–8 weeks before harvest. Apply on warm days when ants are active. Soil should be moist, but not wet. Annual application(s) of bait product should provide good fire ant suppression.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	
SILVER TIP—When swollen buds first begin to break and show silver color.		
Fire Blight	<i>copper hydroxide</i> Nordox 75WG, Dupont Kocide 3000 and others	Should not be applied after 1/4-inch green tip due to phytotoxicity problems. This can be an important spray for fire blight in orchards with lower disease pressure.
Black Rot	<i>captan</i> Captan 50WP	Sprays applied at silver tip are important for black rot.

HOME APPLE AND PEAR DISEASE AND INSECT GUIDE

PEST	MATERIAL OR ACTION	COMMENTS
SILVER TIP TO ½ INCH GREEN TIP		
Fire Blight	<i>streptomycin sulfate</i> Ferti-Lome Streptomycin	May be needed on susceptible cultivars. Apply <i>streptomycin</i> every 7 days, or before or after rain, from ¼-inch green tip to petal fall.
	<i>copper hydroxide</i> Dupont Kocide 3000, Nordox 75WG Monterey Liqui-Cop, others	Do not apply after ¼-inch green tip.
Scab and Leaf Spots Use these sprays only if scab or leaf spots have been problems in the past. Generally not needed.	<i>captan</i> Captan 50WP	
	<i>sulfur</i> Ferti-Lome, Bonide, others	Do not apply sulfur within 4 weeks of oil or at temperatures above 90°F.
TIGHT CLUSTER TO PINK—From tightly clustered flower clusters to pink petals clearly showing in the center of swollen flower buds		
Fire Blight	<i>streptomycin sulfate</i> Ferti-Lome Streptomycin	May be needed on susceptible cultivars. Apply <i>streptomycin</i> every 7 days, or before or after rain, through bloom.
Black rot, Scab, Powdery Mildew, Cedar-Apple Rust	<i>captan</i> Captan 50WP	
	<i>myclobutanil</i> Spectracide Immunox	Can be alternated with captan in orchards with a history of cedar-apple rust. Do not use more than 5 applications of myclobutanil in a year.
Aphids, Leafminers, and Plant Bugs	<i>bifenthrin + zeta-cypermethrin</i> Ortho Bug B Gon Insect Killer for Lawns & Gardens	<i>Bifenthrin</i> is also a miticide. Unfortunately, repeat use tends to result in rebounds of spider mite populations, so alternating with horticultural oil or insecticidal soap is suggested if mite control is needed. Labeled only for pear use.
	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>malathion</i> Bonide Malathion Concentrate Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> has some activity against most aphids, plant bugs, and leafhoppers. Use of malathion seldom induces secondary pests such as mites, scale or aphids. Labeled only for pear use.
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	<i>Permethrin</i> , <i>esfenvalerate</i> , and <i>bifenthrin</i> are pyrethroids. They have some activity against most aphids, plant bugs, and leafhoppers. Frequent use of pyrethroid insecticides often encourages mite and scale problems. Pyrethroid products are highly toxic to bees; do not use them in orchards from first bloom until after petal fall in the last varieties to bloom. Note: Insecticides sprayed up to pink bud stage reduce the need for insecticides just before or after bloom, when they may harm honeybees and other pollinators.
BLOOM *** DO NOT APPLY INSECTICIDES DURING BLOOM ***		
Fire Blight	<i>streptomycin sulfate</i> Ferti-Lome Streptomycin	May be needed on susceptible cultivars. Apply <i>streptomycin</i> every 7 days, or before or after rain, from silver tip to petal fall.
Black Rot and Scab	<i>captan</i> Captan 50WP	
Cedar-Apple Rust, Cedar-quince rust, Cedar-hawthorn rust	<i>myclobutanil</i> Spectracide Immunox	Spray only if there is a history of damage. Can be alternated with captan in orchards with a history of cedar-apple rust. Do not use more than 5 applications of <i>myclobutanil</i> in a year.
PETAL FALL *** DO NOT APPLY INSECTICIDES AT PETAL FALL ***		
Black Rot, Scab	<i>captan</i> Captan 50WP	
Cedar-Apple Rust, Cedar-quince rust, Cedar-hawthorn rust	<i>myclobutanil</i> Spectracide Immunox	Only use Immunox if cedar-apple rust has been a problem in the past. Do not use more than 5 applications of <i>myclobutanil</i> in a year.

PEST	MATERIAL OR ACTION	COMMENTS
EARLY FRUIT SET		
Oriental Fruit Moth, Codling Moth and/or Tufted Apple Bud Moth.	<i>bifenthrin + zeta-cypermethrin</i> Ortho Bug B Gon Insect Killer for Lawns and Gardens	<i>Bifenthrin</i> is also a miticide. Unfortunately, repeat use tends to result in rebounds of spider mite populations, so alternating with horticultural oil or insecticidal soap is suggested if mite control is needed. Labeled only for pear use.
	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>malathion</i> Bonide Malathion Concentrate Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> has some activity against Oriental fruit moth, codling moth, and tufted apple bud moth and occasional pests such as stink bugs or grasshoppers. Use of <i>malathion</i> seldom induces secondary pests such as mites, scale, or aphids. Labeled only for pear use.
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	<i>Permethrin</i> , <i>esfenvalerate</i> , and <i>bifenthrin</i> are pyrethroids. They have activity against Oriental fruit moth, codling moth, and tufted apple bud moth, and occasional pests such as stink bugs or grasshoppers. Frequent use of pyrethroid insecticides often encourages mite and scale problems. Pyrethroid products are highly toxic to bees; do not use them in orchards from first bloom until petals have fallen. NOTE: Insecticides applied at early fruit set and again 14 days later will often provide adequate insect control until pre-harvest.
SUMMER COVER SPRAYS		
Bitter Rot, Sooty Blotch, Fly Speck	<i>captan</i> Captan 50WP	Apply every 14 days until 4 weeks before harvest. Apply promptly at first sign of bitter rot.
	<i>copper</i> Dupont Kocide 3000 Nordox 75WG Bonide Liquid Copper, others	Alternate <i>copper</i> with <i>sulfur</i> every 7–10 days. Do not apply <i>sulfur</i> within 4 weeks of oil or at temperatures above 90°F. <i>Copper</i> may be phytotoxic to fruit or foliage.
	<i>sulfur</i> Ferti-Lome, Bonide, others	Do not apply <i>sulfur</i> within 4 weeks of oil or at temperatures above 90°F.
Codling Moth, Oriental Fruit Moth, Tufted Apple Bud Moth, and/or Stink Bugs	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray	After applying at early fruit set and 14 days later, monitor fruit 2 times each week for damage, and treat as-needed. <i>Carbaryl</i> has activity against Oriental fruit moth, codling moth and tufted apple bud moth and occasional pests such as stink bugs or grasshoppers. Frequent use of <i>carbaryl</i> may encourage mite and scale problems. Note, <i>carbaryl</i> is no longer the active ingredient in Sevin Insect Killer.
	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>malathion</i> Bonide Malathion Concentrate Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> has some activity against Oriental fruit moth, codling moth, tufted apple bud moth, grasshoppers, leafhoppers, and stink bugs. Use of <i>malathion</i> seldom induces secondary pests such as mites, scale, or aphids. Labeled only for pear use.
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	<i>Permethrin</i> and <i>esfenvalerate</i> , are pyrethroids. They have activity against Oriental fruit moth, codling moth and tufted apple bud moth, and occasional pests such as stink bugs or grasshoppers. Frequent use of pyrethroid insecticides often encourages mite and scale problems.
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes	Annual applications in the spring and again 6–8 weeks pre-harvest should provide good fire ant control. Apply in the spring and again 6–8 weeks pre-harvest. Apply when ants are actively foraging on warm sunny days when soil is moist but not saturated.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	

HOME APPLE AND PEAR DISEASE AND INSECT GUIDE

PEST	MATERIAL OR ACTION	COMMENTS
PRE-HARVEST—Apply sprays 14 days and 7 days before the anticipated first harvest in each variety.		
Bitter Rot, Sooty Blotch, Fly Speck	<i>captan</i> Captan 50WP	Apply if needed.
Stink Bugs, Plant Bugs, Oriental Fruit Moth, Codling Moth, and/or Tufted Apple Bud Moth	<i>bifenthrin + zeta-cypermethrin</i> Ortho Bug B Gon Insect Killer for Lawns & Gardens	<i>Bifenthrin</i> is also a miticide. Unfortunately, repeat use tends to result in rebounds of spider mite populations, so alternating with horticultural oil or insecticidal soap is suggested if mite control is needed. Labeled only for pear use.
	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray	<i>Carbaryl</i> has activity against codling moth, Oriental fruit moth, and tufted apple bud moth, and occasional pests such as stink bugs and green June beetles.
	<i>esfenvalerate</i> Ortho Bug B Gon Multi-Purpose Insect Killer Ready-To-Use	
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	<i>Permethrin</i> , <i>esfenvalerate</i> , and <i>bifenthrin</i> are pyrethroids. They have activity against codling moth, Oriental fruit moth, and tufted apple bud moth, and occasional pests such as stink bugs and green June beetles.

DISEASE RESISTANCE IN SOME COMMON APPLE CULTIVARS

	MODERATELY RESISTANT			HIGHLY SUSCEPTIBLE		
	FIRE BLIGHT	SUMMER ROTS	CEDAR APPLE RUST		FIRE BLIGHT	SUMMER ROTS
Arkansas Black	X	X	X	Braeburn	X	X
Golden Delicious	X	X		Empire	X	X
Goldrush	X			Fuji	X	X
Jonafree	X	X		Gala	X	X
Liberty	X	X	X	Ginger Gold	X	X
Ozark Gold	X			Granny Smith	X	X
Redfree	X		X	Jonagold	X	X
Williams Pride	X	X	X	Molly's Delicious	X	X
Winesap	X			Pink Lady	X	X
Yates	X	X		September Wonder	X	X

FIRE BLIGHT RESISTANCE IN PEAR CULTIVARS

MODERATELY RESISTANT	HIGHLY SUSCEPTIBLE
Kieffer	D'Anjou
LeConte	Bartlett
Magness	Bosc
Maxine	Clapp's Favorite
Moonglow	Comice
Old Home	Red Bartlett
Orient	Starkrimson
Warren	Winter Nellis

HOME BLUEBERRY DISEASE AND INSECT GUIDE

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BLUEBERRY DISEASES

Rabbiteye blueberries (*Vaccinium ashei*) are native to the Southeast and can sometimes be grown with little or even no fungicide treatments, especially if attention is paid to sanitation, mulching, fertilization, and pH. Rabbiteye blueberries make a much better choice for the homeowner than highbush varieties, which in addition to being more difficult to grow also have more serious disease problems. Mummy berry is the most common disease of rabbiteye blueberries. The mummy berry pathogen infects the flowers in the spring and the berries become hard and mummified. Infected berries (mummies) fall to the ground and serve as the overwintering mechanism for this disease. Burying or mulching mummies during the winter helps to prevent flower infections. Bloom sprays with fungicides may be necessary when there is a history of mummy berry in a planting.

Phomopsis and Botryosphaeria twig blight are caused by pathogens that attack weakened (poor growing conditions) or damaged (such as from cold) twigs and stems resulting in poor growth and death of affected plant parts. The fungal pathogens survive in the damaged branches. Pruning to remove dead and weak twigs and stems not only prevents future infections but also opens up the canopy for good air circulation and allows for the growth of new vigorous stems.

Botrytis flower blight may occur occasionally and is most prevalent when rainy conditions and/or freezing conditions occur during bloom.

Leaf spot diseases may occur in wet years, but they are not generally considered a problem on rabbiteye cultivars in home orchards.

BLUEBERRY INSECT AND MITE PESTS

Home garden blueberries typically experience light to moderate pest pressure from insects and mites. Regular monitoring and occasional as-needed insecticides normally provide adequate protection from insects and mites. Home blueberries that have previously been infested with blueberry maggot or spotted wing drosophila (fruit fly) will require regular insecticide applications.

Armored and soft scale insects are small sap-feeding occasional pests of blueberries. Scale feed by inserting their syringe-like mouthparts into stems. Scale spread by moving during their first nymphal stage. Thereafter, only the adult males move about. A few days after settling, scale crawlers insert their mouthparts into the host plant and develop a scale, which protects them in a turtle shell-like fashion. Scale species are often well camouflaged. If

scale are observed, dormant or delayed dormant application of horticultural oil at concentrations of 1–3%, 1–3 fl oz oil/ gallon of water, are recommended. Reduce the oil concentration to 1% just after leaf drop and again just before bloom. Do not apply oil when temperatures are expected to be higher than 65°F or lower than 30°F within 24 hours. Do not use within 14 days of applying sulfur or sulfur-containing fungicides, such as *captan*.

Fire ants are nuisance pests when working in orchards. Except for recently transplanted plants, which can be engulfed in mounds, fire ants do almost no direct harm to fruit crops. However, many home gardeners will find it worthwhile to treat their orchards with fire ant baits annually. Ant baits provide the most effective control, but they work slowly, requiring 4–8 weeks to reduce ant numbers. Ants must be actively foraging for baits to work well. Apply ant baits on warm, sunny days in the spring and again 6–8 weeks before harvest.

Blueberry gall midges are occasional, yield-reducing pests of rabbiteye blueberries. Pre-bloom gall midge damage, seen as dried out, aborted flower buds, is easily mistaken for cold injury or poor fruit set. Female midges lay their eggs into flower buds on warm winter days when bud scales initially show separation. Insecticide applications for gall midge are only worthwhile in orchards with a history of severe midge damage. Contact your county Extension office for a gall midge control program if you feel your blueberries have an on-going, serious gall midge problem.

Flower thrips can reduce fruit set and reduce yield in rabbiteye blueberries. The risk of thrips-induced yield losses in home orchard blueberries is outweighed by the risks insecticides applied just before bloom pose to bees and other pollinator species.

Cranberry and cherry fruitworms are seldom-encountered caterpillar pests of blueberries in Georgia. Infestations typically develop within a 30-day window beginning at petal fall. Early varieties such as “Climax” or “Premier” are typically infested first. Observe fruit clusters for eggs on the calyx end of berries, tiny worm holes, frass or webbing. Treat if more than 10% of fruit clusters are infested.

Leaffooted bugs and occasionally redshouldered stink bugs feed on ripening blueberries. Feeding by these bugs, which are damaging in many other crops, has little if any impact on blueberry yield, shelf life, or flavor. Spraying for leaffooted bugs and stink bugs is not necessary in home garden blueberries.

Blueberry maggot is very seldom seen, but is a severe, fruit-infesting pest. Blueberry maggot adults are $\frac{3}{16}$ -inch long black flies. There are distinctive white bars on either

HOME BLUEBERRY DISEASE AND INSECT GUIDE

side of the thorax, immediately forward of the wings, a white spot on the posterior tip of the thorax, and a thin white stripe along the back of each abdominal segment. The wings are clear with a very distinctive black-banding pattern. Females insert their eggs into ripening berries as they develop a reddish or blue color. Adults can be monitored using yellow sticky cards laced with a *hydrolysate*- or *ammonium acetate*-based protein bait.

Mature larvae are ½ inch, white, carrot-shaped, legless maggots with no eyes or antennae. In home orchards with a history of blueberry maggot infestations, alternate applications of *spinosad* and pyrethroid products should be applied at weekly intervals from June 1 through the last harvest.

Spotted wing drosophila (aka spotted wing fruit fly or SWD) is a serious, new exotic fruit-feeding pest of strawberries, blueberries, blackberries, sweet cherries, and grapes. SWD attacks sound blueberries as they begin to mature and turn blue. Unlike other vinegar flies, SWD attacks and destroys sound fruit as it ripens. Females lay eggs in ripening berries. Initially maggots are quite tiny; they are clear and tapered on both ends. To control SWD either: 1) spray 1 time per week from the time fruit begins to turn blue. If heavy or frequent rains occur, spray 2 times per week. 2) If maggots are found, pick and remove all blue fruit, ripe fruit, and drops from beneath the bushes. These fruits should be buried or bagged and disposed of off-site. To regain control, apply insecticide 2 times per week for 2 weeks. Alternate applications of *spinosad* and a pyrethroid (*permethrin*, *esfenvalerate*, or *bifenthrin*) to control SWD. Alternating insecticides from one spray to the next reduces the risk of SWD resistance to insecticides. Excessive use of pyrethroids can lead to secondary pest outbreaks from mites and/or scale insects. UGA has a publication on organic management of spotted wing drosophila:

<https://extension.uga.edu/publications/detail.html?number=B1497>.

Yellownecked caterpillar, azalea caterpillar, and two related species of large, gregarious, dark-headed, conspicuously striped foliage feeding caterpillars are occasional summer and early fall pests of blueberry. Young bushes can be stunted if heavily defoliated, which reduces yields until regrowth of the canopy compensates. Yellownecked caterpillars feed in groups when young, and often will be found aggregated on individual limbs of scattered bushes. Pruning out and removing heavily infested limbs is an effective cultural control. *Spinosad*, *Bacillus thuringiensis*, *carbaryl*, and pyrethroids are all effective against these caterpillars, but larvae ¼ inch or longer are difficult to kill.

Flea beetles and leaf beetles are occasional pests that can be significant on young bushes where heavy infestations can cause stunting and delay maturation of bushes. *Carbaryl*, *spinosad*, and pyrethroids are effective when control of leaf feeding beetles is necessary.

Blueberry bud mite is an occasional pest of Georgia blueberries. These tiny mites infest flower buds in late summer. Infested flower buds will be reddened, deformed rosettes the next spring. Blueberry bud mite is very tiny and cannot be seen without the aid of a microscope. Even on infested bushes, blueberry bud mites are very seldom seen except for a few days each year when their mobile life stage moves from one bud to another. Cultural control in the form of shearing the previous year's growth after harvest suppresses bud mites. Shearing removes existing infested buds and delays development of the next year's bud crop, making it difficult for immature bud mites to successfully infest the coming year's flower buds. Application of a summer, or verdant, horticultural oil applied in high volume near the point of runoff just prior to completion of flower bud formation can provide additional suppression of bud mites.

PEST	MATERIAL OR ACTION	COMMENTS
DORMANT—buds tight		
Armored and/or Soft Scale	<i>dormant and verdant horticultural oils</i> Bonide All Seasons Horticultural & Dormant Spray Oil SunSpray Ultra-Fine Pest Oil (verdant)	Treat as needed if scale are present Horticultural oils applied for scale also provide a degree of control for blueberry bud mite and other soft-bodied insect pests, such as aphids. Horticultural oils can cause fruit finish injury and foliar injury, particularly when applied in warm to hot temperatures. Do not apply horticultural oils with or within 14 days of applying sulfur or sulfur-containing fungicides such as <i>captan</i> . Some horticultural oils are organic (OMRI-approved).
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes	Fire ants may be a nuisance when working in vineyards or orchards. Ant baits or stakes are effective, but slow-acting, taking some 8 weeks to work. Apply baits in the spring and again 6–8 weeks before harvest. Apply on warm days when ants are active. Soil should be moist, but not wet.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	

PEST	MATERIAL OR ACTION	COMMENTS
DELAYED DORMANT—buds have swelled		
<p>The fungi causing Botrytis blight and mummy berry overwinter in dead berries and debris under the bushes. Sanitation in the form of removing dead berries and debris under the bushes during the winter will reduce disease pressure from Botrytis blight and mummy berry. Compost or destroy debris. Replace with new mulch. Do not place mulch right up against the trunk of the plant. With good sanitation and little or no history of Botrytis blight and mummy berry there should be no need for sprays. If these diseases have been damaging in the past, spray <i>captan</i> every 7–10 days through bloom.</p>		
Gall Midge and/or Thrips	<i>spinosad</i> Natural Guard Sinosad	<i>Spinosad</i> products have activity against gall midge, flower thrips, caterpillars, leaf and flea beetles, and spotted wing fruit fly. Some <i>spinosad</i> products are organic (OMRI-approved).
GREEN TIP—from the first green tissue after bud break to first bloom		
Botrytis Blight	<i>captan</i> Captan 50WP	
10-20% BLOOM TO FULL BLOOM		
Mummy Berry, Botrytis Blight, Leaf Spots	<i>Bacillus subtilis strain QST713</i> Serenade MAX, Serenade ASO	Organic approved fungicide option. Serenade has been shown to reduce mummy berry infections if applied at shortest labeled interval during bloom. Will not be as effective as <i>captan</i> . Cultural management is very important for reducing mummy berry
	<i>captan</i> Captan 50WP	DO NOT APPLY INSECTICIDES DURING BLOOM. Spray for these diseases only if there is history of a problem. Botrytis causes flower and twig blight. Good air circulation around fruit clusters will help prevent anthracnose. For leaf spots, apply post bloom through Aug–Sept at 7–10 day intervals. SANITATION is key for management of these diseases (esp. mummy berry).
PETAL FALL—to berries turning red to blue		
Cranberry or Cherry Fruitworms	<i>spinosad</i> Natural Guard Spinosad	<i>Spinosad</i> products have activity against spotted wing fruit fly, blueberry maggot, caterpillars, and flea beetles. Some <i>spinosad</i> products are organic (OMRI-approved).
SUMMER COVER		
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes	Apply in the spring and again 6–8 weeks pre-harvest. Apply when ants are actively foraging on warm sunny days when soil is moist but not saturated.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	Annual applications in the spring and again 6–8 weeks pre-harvest should provide good fire ant control.
PRE-HARVEST—berries progressing from red to mature fruit		
Spotted Wing Drosophila Treat for blueberry maggot in fields with a history of blueberry maggot infestations.	<i>Bacillus thuringiensis kurstaki (Bt)</i> Garden Safe Bt Worm & Caterpillar Killer	<i>Bacillus thuringiensis kurstaki (Bt)</i> products control caterpillars. <i>Bt kurstaki</i> controls small to medium size, ½ inch or less, foliage- feeding caterpillars. Bt products do not control SWD, blueberry maggot, or other non-caterpillar pests. Bt products are organic, OMRI- approved insect pathogens.
	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	<i>Permethrin</i> and <i>esfenvalerate</i> are pyrethroids. They have activity against spotted wing fruit fly, blueberry maggot, flea beetles, and caterpillars. Frequent use of <i>pyrethroid</i> insecticides may encourage mite problems.
	<i>spinosad</i> Natural Guard Spinosad	<i>Spinosad</i> products have activity against spotted wing fruit fly, blueberry maggot, caterpillars, and flea beetles. Some <i>spinosad</i> products are organic (OMRI-approved).
Japanese Beetles	<i>malathion</i> Bonide Malathion Concentrate	
	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray	<i>Carbaryl</i> also has activity against flea beetles, caterpillars, and crickets. Frequent use of <i>carbaryl</i> may encourage mite problems. Note, <i>carbaryl</i> is no longer the active ingredient of Sevin Insect Killer.

HOME BRAMBLE DISEASE AND INSECT GUIDE

Elizabeth Little, Extension Plant Pathologist
Brett Blaauw, Extension Entomologist

Blackberries can often be grown successfully with limited pesticide use if home orchardists use good growing practices and have no wild blackberries nearby. Several important fungal and insect pests of blackberry canes overwinter on old infested canes. Cut old canes to the ground after harvest and either remove the old canes or burn them. Do not cut old canes with a rotary mower as pieces will become too small to remove. Removing fruiting canes immediately after harvest prevents transfer of cane diseases to the developing primo-canecan. Applying copper immediately after pruning and as a late dormant spray can be effective for preventing cane diseases. Planting in a sunny spot, optimizing fertility, keeping weeds in check, and drip irrigating during dry periods will also help keep brambles healthy.

Fall-fruiting raspberry cultivars such as “Heritage” should be renovated annually by cutting and removing old fruiting canes in early spring before new shoots begin to grow. Spring raspberry renovation forces plants to bear a single fall crop. Strawberry weevil is not a problem on fall bearing raspberry cultivars. A week to 10 days after renovation, raspberry plants should be fertilized and irrigated to force new growth for next year’s crop.

Rust Diseases: Two rusts commonly infect brambles. Cane and leaf rust (*Kuehneola uredines*) causes yellow lesions on the canes and is treatable by removing fruiting canes immediately after harvest is completed. Sprays during bud break may also help if history of disease (see below). Orange rust (*Gymnoconia nitens*) is a systemic rust that attacks all brambles except for red raspber-

ries. Once plants are infected they remain so for life. Infected plants are stunted and produce very little fruit. Infected plants can be identified in the early spring after new leaves emerge. The lower surface of infected leaves develop orange pustules that give the disease its name. Prompt removal of infected plants is most important to avoid spread. Dig up, remove, and dispose of or destroy these plants. Nearby wild brambles should also be destroyed. Inspect plants for orange rust at least weekly in early spring to identify the pustules before the orange spores are released. The spores cause new infections that may not show up until the following spring. There are no labeled fungicides that control orange rust. Contact your Extension office for an accurate diagnosis. For more info and images: <https://www.raspberryblackberry.com/is-it-blackberry-leaf-rust-or-orange-rust/>.

Double Blossom Disease is an important disease on brambles. See more information below.

Spotted wing drosophila (aka SWD or spotted wing fruit fly) is an aggressive, new exotic pest of Asian origins. Most brambles (blackberries or raspberries) grown in Georgia will require weekly, perhaps 2 times per week, insecticide treatment for SWD from the time fruit turn black or red through harvest. Additional sprays may be required if rain washes off insecticides or berries become infested before sprays are begun. UGA has a publication on organic management of spotted wing drosophila: <https://extension.uga.edu/publications/detail.html?number=B1497>.

PEST	MATERIAL OR ACTION	COMMENTS
DELAYED DORMANT		
Anthracnose, Cane Disease	<i>copper</i> Dupont Kocide 3000 Monterey Liqui-Cop	Apply as delayed dormant spray after training in the spring.
Raspberry Crown Borer	Remove and destroy dead canes whenever they are found.	Cut and either remove or burn old canes. Do not cut and drop- dead canes in middles, as mowing will not adequately eliminate overwintering life stages. If removal of infested canes does not provide acceptable control/ suppression, select an insecticide and mix at that product’s maximum label rate, apply as a soaking drench, approximately 1 gallon final mix per foot of row. Apply at Delayed Dormant and again at Green Tip.
	<i>bifenthrin + zeta-cypermethrin</i>	
	<i>esfenvalerate</i>	
	<i>permethrin</i>	
Fire Ants	avermectin Raid Outdoor Ant Stakes	Fire ants are nuisance pests in vineyards or orchards. Ant baits or stakes are effective, but slow-acting, taking some 8 weeks to work. Apply in the spring and again 6–8 weeks pre-harvest. Apply when ants are actively foraging on warm sunny days when soil is moist but not saturated.
	spinosad Ferti-Lome Come and Get It Fire Ant Killer	

PEST	MATERIAL OR ACTION	COMMENTS
SHOOTS 6-INCHES LONG UNTIL FIRST BLOOM		
Strawberry Clipper (Aka Strawberry Weevil)	<i>bifenthrin + zeta-cypermethrin</i> Ortho Bug B Gon Insect Killer for Lawns & Gardens	As needed treatment for strawberry clipper when flower buds have been clipped (dangling) or have fallen to the ground or clippers are seen. Brambles with a history of damaging clipper injury should be treated as soon as the first clipped buds are observed.
	<i>esfenvalerate</i>	
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	
Gail Midge	<i>bifenthrin + zeta-cypermethrin</i>	Treat 1–3 times as needed for blackberry gall midge if midge damage has been severe in previous years. Treat on warm winter days beginning when flower bud scales first start to separate from the buds. Repeat during warm spells pre-bloom.
	<i>esfenvalerate</i>	
	<i>permethrin</i>	
GREEN TIP		
Anthracnose, Leaf and Cane Rust	<i>copper</i> Dupont Kocide 3000, Monterey Liqui-Cop	Avoid overhead watering. Labeled <i>copper</i> products available under several different brand names.
Orange rust attacks all brambles except for red raspberries. Once plants are infected they remain so for life. Infected plants are stunted and produce very little fruit. Infected plants can be identified in the early spring after new leaves emerge. The lower surface of infected leaves develop orange pustules that give the disease its name. Prompt removal of infected plants is most important to avoid spread. Dig up, remove, and dispose of or destroy these plants. Nearby wild brambles should also be destroyed. Inspect plants for orange rust at least weekly in early spring to identify the pustules before the orange spores are released. The spores cause new infections that may not show up until the following spring. There are no labeled fungicides that control orange rust. Contact your Extension office for an accurate diagnosis.		
WHEN BUDS APPEAR AND NEW CANES ARE 8–12" HIGH UNTIL PRE-BLOOM		
Anthracnose	<i>copper</i> Dupont Kocide 3000, Monterey Liqui-Cop	
	<i>Captan</i> Captan WP50	
Leaf and Cane Rust	<i>myclobutanil</i> Spectracide Immunox	If history of leaf and cane rust, apply at bud break and again every 10 to 14 days through bloom. Do not apply more than 4 times in a season.
BLOOM		
Botrytis Flower Blight, Powdery Mildew, Botrytis Fruit Rot	<i>copper</i> Bonide Liquid Copper, Monterey Liqui-Cop	Apply copper at the start of lowering and continue every 7–10 days until harvest.
	<i>Captan</i> Captan WP50	DO NOT SPRAY INSECTICIDE DURING BLOOM.
Rosette or double blossom (<i>Cercospora rubi</i>) occurs on both blackberries and raspberries, but is most damaging to blackberries. Symptoms are unusual and markedly change the appearance of the plant. In the spring, infected buds from the previous year produce numerous leafy sprouts. This proliferation of shoots is referred to as a witch's broom. Several of these witch's brooms may occur on one cane. As flower buds open, petals are pinkish in color, wrinkled and twisted. Berries do not develop from infected blossoms and uninfected parts of the same plant produce smaller, poorer quality fruit. Sanitation to prevent this disease is similar to that of orange rust. Wild brambles should be removed from the immediate area. They can serve as sources of inoculum. Remove and destroy old fruited canes after harvest. Infected blossom clusters should be removed before they open. Where this disease is especially severe on trailing blackberries, cut off plants at the ground after fruiting. This extreme practice only works well where the growing season is long. For other brambles, cut fruiting canes close to the ground and primocanes back to 12 inches immediately after harvest. Fertilize and irrigate plants to force new growth on the primocanes before winter.		
SUMMER COVER		
Fire Ants Annual applications in the spring and again 6–8 weeks pre-harvest should provide good fire ant control.	<i>avermectin</i> Raid Outdoor Ant Stakes	Apply in the spring and again 6 to 8 weeks pre-harvest. Apply when ants are actively foraging on warm sunny days when soil is moist but not saturated.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	

HOME BRAMBLE DISEASE AND INSECT GUIDE

PEST	MATERIAL OR ACTION	COMMENTS
PRE-HARVEST		
<p>Spotted Wing Fruit Fly (SWD) should be treated preventatively 1–2 times per week for SWD. Begin insecticide applications after black raspberries or blackberries begin to turn black or red raspberries begin to turn red.</p> <p>Spray as needed for Spider Mites, Grasshoppers, and/or Sap Beetles.</p>	<p><i>bifenthrin + zeta-cypermethrin</i> Ortho Bug B Gon Insect Killer for Lawns and Gardens</p>	<p><i>Bifenthrin</i> is also a miticide. Do not apply any pyrethroids until bloom is over. Unfortunately, repeat use tends to result in rebounds of spider mite populations, so alternating with horticultural oil or insecticidal soap is suggested.</p>
	<p><i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray Garden Tech Sevin-5 Dust</p>	<p><i>Carbaryl</i> has activity against strawberry clipper, grasshoppers, and caterpillars. Frequent use of carbaryl may encourage mite problems. Note, <i>carbaryl</i> is no longer the active ingredient for Sevin Insect Killer</p>
	<p><i>dormant and verdant horticultural oils</i> SunSpray Ultra-Fine Pest Oil (verdant) Bonide All Seasons Horticultural & Dormant Spray Oil</p>	<p>Horticultural oils provide a degree of control for mites, aphids, and other soft-bodied insect pests. Horticultural oils can cause fruit finish injury and foliar injury, particularly when applied in warm to hot temperatures. Do not apply horticultural oils with or within 14 days of applying <i>sulfur</i> or <i>sulfur</i>-containing fungicides such as <i>captan</i>. Some horticultural oils are organic (OMRI-approved).</p>
	<p><i>esfenvalerate</i> Monterey Bug Buster II</p>	
	<p><i>insecticidal soaps</i> Safer Insect Killing Soap Bayer Advanced Natria Insecticidal Soap</p>	<p>Select soap products provide a degree of control for mites, aphids and other soft-bodied insect pests. However, insecticidal soaps can cause fruit finish injury and foliar injury, particularly when applied in warm to hot temperatures. Some insecticidal soaps are organic (OMRI- approved).</p>
	<p><i>malathion</i> Bonide Malathion Concentrate</p>	<p><i>Malathion</i> has activity against spotted wing fruit fly, grasshoppers, and caterpillars. Use of malathion seldom induces secondary pests such as mites or aphids.</p>
	<p><i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower</p>	<p><i>Permethrin</i>, <i>esfenvalerate</i>, and <i>bifenthrin</i> are pyrethroids. They have activity against spotted wing fruit fly, caterpillars, and grasshoppers. Frequent use of pyrethroid insecticides may encourage mite problems. Do not apply any pyrethroids until bloom is over.</p>
<p><i>spinosad</i> Gardens Alive Bull's-Eye Bioinsecticide</p>	<p><i>Spinosad</i> products have activity against spotted wing fruit fly, grasshoppers, and caterpillars. Some <i>spinosad</i> products are organic (OMRI-approved).</p>	
POST-HARVEST— after old canes have been removed		
<p>Anthracnose, Leaf and Cane Rust</p>	<p><i>copper</i> Dupont Kocide 3000, Monterey Liqui-Cop</p>	<p>See introductory section. Labeled <i>copper</i> products are available under several different brand names.</p>
<p>Orange Rust</p>	<p>Avoid overhead watering. This is a systemic rust and there is no effective treatment once a plant is infected. Promptly remove and destroy infected plants.</p>	

HOME BUNCH GRAPE DISEASE AND INSECT GUIDE

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Bunch and wine grapes (*Vitis vinifera*) originate in the Mediterranean region of the old world and are very difficult to grow in Georgia's climate due to an abundance of diseases. In particular, Pierce's Disease (*Xylella fastidiosa*) is a native disease that will quickly kill *V. vinifera* grapes in most areas of the state except high in the mountains

of north Georgia. Native grapes such as muscadines are immune to most diseases and are a better choice for the home grower. Some Pierce's disease-resistant *V. vinifera* crosses with native grapes may be available but these can still get many of the other diseases. Success with growing bunch grapes takes careful management.

PEST	MATERIAL OR ACTION	COMMENTS
DORMANT—MID-WINTER		
<p>Dormant pruning—Annual pruning is essential for the consistent production of high-quality grapes. Pruning removes fruiting wood of declining productivity, encouraging the growth of fruitful new wood for next year’s crop, opens the canopy to sunlight, air and spray penetration, adjusts crop load and eliminates dead, diseased or insect-infested wood. Prunings and leaves or fruit on the ground should be regularly removed from the vineyard or burned. Generally, the later in the dormant season that pruning can be done, the better it is. In fact, pruning after growth has started can be used as a way to delay bud break, thus possibly escaping damage from a late frost. Double pruning (a rough pruning in the fall or winter, then a final pruning in the spring) can reduce the risk of some woody/vascular diseases, such as Botryosphaeria canker.</p>		
European Red Mite Eggs, Mealybugs, Scale	<i>dormant horticultural oil</i> Bonide All Seasons Horticultural & Dormant Spray Oil	Apply 2 times during the dormant season. Do not apply horticultural oil with or within 14 days of applying liquid <i>lime sulfur</i> , <i>captan</i> , or <i>sulfur</i> .
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes	Fire ants are nuisance pests in vineyards or orchards. Ant baits or stakes are effective, but slow-acting, taking some 8 weeks to work. Apply baits in the spring and again 6–8 weeks before harvest. Apply on warm days when ants are active. Soil should be moist, but not wet.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	
BUD SWELL—(buds visibly swollen, but no green or pink tissue showing)		
Mealybugs	<i>cyfluthrin</i> Bayer Advanced Vegetable & Garden Insect Spray	Mealybugs are scale-like insects that are covered by wax. They are occasionally pests of grapes in Georgia. Treat as needed if mealybugs are seen pre-bloom. If mealybugs are present, apply insecticide. Thorough coverage is necessary, wet the canes, particularly if mealybugs are under loose bark.
	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>malathion</i> Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> has some activity against grape berry moth, grape curculio, flea beetles, grasshoppers, leafhoppers, and stink bugs.
PRE-BLOOM— beginning with 1-2 inches green, apply every 7 days until bloom		
Black Rot, Powdery Mildew, Downy Mildew, Anthracnose	<i>mancozeb</i> Bonide Mancozeb Flowable with Zinc	Use mancozeb if downy mildew is a problem.
	<i>myclobutanil</i> Immunox	Use Immunox if anthracnose is a problem. Do not make more than 6 applications of Immunox at 2 oz/gallon per season.
BLOOM—10% BLOOM AND FULL BLOOM Do not apply insecticides of any kind during bloom or injury to bees and other pollinators is likely to occur.		
Black Rot, Powdery Mildew	<i>captan</i> Captan 50WP	Do not use home orchard sprays with insecticide during bloom.
	<i>mancozeb</i>	Do not apply <i>mancozeb</i> within 66 days of harvest.
	<i>myclobutanil</i> Immunox	Do not make more than 6 applications of Immunox in a season.
CAP FALL AND 1ST COVER (10 DAYS AFTER CAP FALL)		
Black Rot, Powdery Mildew	<i>captan</i> Captan 50WP	
	<i>sulfur</i> Bonide Liquid Sulfur	Effective treatment for powdery mildew. Should not be used when the temperature is above 90°F or within 4 weeks of an oil spray.
Downy Mildew	<i>captan</i> Captan 50WP	Can be tank mixed with phosphorous acid
	<i>copper hydroxide</i> Bonide Copper Spray or Dust Bonide Liquid Copper	Foliage injury may occur on <i>copper</i> sensitive varieties such as Concord, Delaware, Niagara, and Rosettes. Test for sensitivity.
	<i>phosphorous acid</i> Agri-phos, ProPhyt	Can be phytotoxic. Test small area of plant first. Can be tank mixed with <i>captan</i> to increase downy mildew control.

HOME BUNCH GRAPE DISEASE AND INSECT GUIDE

PEST	MATERIAL OR ACTION	COMMENTS
CAP FALL AND 1ST COVER (10 DAYS AFTER CAP FALL) (continued)		
Japanese Beetle and/or Grape Berry Moth	<i>azadirachtin</i> Neemix 4.5	OMRI-approved.
	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray Garden Tech Sevin-5 Dust	<i>Carbaryl</i> has some activity against grape berry moth, grape curculio, flea beetles, grasshoppers, leaffooted, and stink bugs. Frequent use of <i>carbaryl</i> may encourage mite problems. Note, <i>carbaryl</i> is no longer the active ingredient for Sevin Insect Killer.
	<i>cyfluthrin</i> Bayer Advanced Vegetable & Garden Insect Spray	<i>Cyfluthrin</i> is a pyrethroid, which has some activity against grape berry moth, grape curculio, Japanese beetle, green June beetle, grasshoppers, leaffooted, and stink bugs. Frequent use of pyrethroids may encourage mite problems.
	<i>malathion</i> Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> has some activity against grape berry moth, grape curculio, flea beetles, grasshoppers, leaffooted and stink bugs. Note, treat as needed if pests and damage are evident.
	<i>malathion + carbaryl</i> Bonide Fruit Tree Spray	
Phylloxera (Foliar)	<i>azadirachtin</i> Neemix 4.5	OMRI-approved.
	<i>carbaryl</i>	Grape phylloxera has root feeding and foliar feeding forms. Grape rootstocks are typically resistant to root feeding phylloxera and do not require treatment. Foliar phylloxera may be problematic in European-American hybrid varieties (i.e., Vidal, Seyval, etc.), or Norton and cause distinctive, wart-like galls on leaves. The mobile crawler stage of phylloxera can be controlled with insecticides, but closed galls are not. If infested leaves are found in susceptible varieties, insecticide treatments should be timed to crawler emergence. Scouting for galls and crawlers should begin once leaves are expanded.
	<i>permethrin</i>	
	Leaf removal—Leaf removal facilitates better sunlight penetration into the canopy, thus lessening disease pressure and increasing fruit quality. Leaves should be removed shortly after fruit set to allow berries to acclimate to higher sunlight levels prior to berry softening. Waiting until after the berries begin to soften increases the risk of sunscald. Leaves in the vicinity of the cluster should be removed. For some varieties, especially white-fruited varieties, sunscald can be severe. Removing leaves on the east side of a north–south oriented row, but not on the west side, gives the advantages of leaf removal while reducing the incidence of sunscald. If the fruit is located at the top of the trellis, the potential for sunscald is high, so leaf removal, if done at all, should be minimal.	
SUMMER COVER SPRAYS EVERY 14 DAYS UNTIL DAYS BEFORE HARVEST		
Black Rot, Powdery Mildew	<i>captan</i> Captan 50WP	
	<i>myclobutanil</i> Immunox	Do not make more than 6 applications of Immunox at 2 oz/gallon per season.
Treat As Needed For Japanese Beetle, Green June Beetle, Grape Berry Moth, Grape Curculio, and/or Fire Ants	<i>azadirachtin</i> Neemix 4.5	OMRI-approved.
	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray Garden Tech Sevin-5 Dust	<i>Carbaryl</i> has some activity against grape berry moth, grape curculio, Japanese beetle, green June beetle, grasshoppers, leaffooted, and stink bugs. Frequent use of <i>carbaryl</i> may encourage mite problems.
	<i>cyfluthrin</i> Bayer Advanced Vegetable & Garden Insect Spray	<i>Cyfluthrin</i> and <i>esfenvalerate</i> are pyrethroids. They have some activity against grape berry moth, grape curculio, Japanese beetle, green June beetle, grasshoppers, leaffooted, and stink bugs. Frequent use of pyrethroids may encourage mite problems.
	<i>esfenvalerate</i> Monterey Bug Buster II	

PEST	MATERIAL OR ACTION	COMMENTS
SUMMER COVER SPRAYS EVERY 14 DAYS UNTIL DAYS BEFORE HARVEST (continued)		
Treat As Needed For Japanese Beetle, Green June Beetle, Grape Berry Moth, Grape Curculio, and/or Fire Ants (continued)	<i>malathion</i> Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> has some activity against grape berry moth, grape curculio, Japanese beetle, green June beetle, grasshoppers, leafhoppers, and stink bugs.
	<i>malathion + carbaryl</i> Bonide Fruit Tree Spray	
	<i>permethrin</i>	
<p>Grape root borers—Left unchecked, borers can kill grapevines. Borers tunnel inside vines at or below ground level, weakening or killing the vines. All grapes (bunch and vinifera) are susceptible. Mounding provides cultural control. Mounding uses layers of soil to make it more difficult for young larvae to reach the roots or adults to emerge. Use clean cultivation, and mound soil 1 foot high and 1½ feet out from the base of each vine to cover the entire area around the base of each vine. This practice will inhibit adult emergence from the soil when well timed; the time for this function will vary by location, early to mid-June for much of Georgia, so check with your county agent for the appropriate time for your location. It is equally important to knock these mounds back down between early November and late December. Mounding is an organically acceptable cultural practice.</p>		
Fire Ants Annual applications in the spring and again 6 to 8 weeks pre-harvest should provide good fire ant control.	<i>avermectin</i> Raid Outdoor Ant Stakes	Apply in the spring and again 6 to 8 weeks pre-harvest. Apply when ants are actively foraging on warm sunny days when soil is moist but not saturated.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	
PRE-HARVEST (7 DAYS BEFORE HARVEST)		
Spotted Wing Drosophila, Yellow Jackets, Wasps and Hornets, Lady Beetle, and/or Green June Beetle Spotted wing drosophila (SWD), fruit fly, recently introduced pest that lays its eggs in maturing soft skinned fruits. SWD was common in Georgia wine grapes in 2013. Wine grapes can likely tolerate greater injury than table grapes. Larvae begin to infest fruit as they ripen, so insecticide treatments should be applied to previously infected vines on a weekly basis through harvest and reapplied in the event of rain.	<i>azadirachtin</i> Neemix 4.5	OMRI-approved.
	<i>cyfluthrin</i> Bayer Advanced Vegetable & Garden Insect Spray	
	<i>esfenvalerate</i> Monterey Bug Buster II	<i>Esfenvalerate</i> and <i>cyfluthrin</i> are pyrethroids. They are standard control options for SWD, they should be alternated with <i>malathion</i> . Frequent use of pyrethroids may encourage mite problems.
	<i>malathion</i> Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> is a standard material for control of SWD and other pre-harvest insect pests. <i>Malathion</i> for SWD should be alternated with a pyrethroid (<i>permethrin</i> and <i>esfenvalerate</i>).
	<i>permethrin</i>	

HOME ORCHARD MUSCADINE GRAPE DISEASE AND INSECT GUIDE

Elizabeth Little, Extension Plant Pathologist
Brett Blaauw, Extension Entomologist

Muscadine grapes may yield satisfactorily without the aid of fungicides, especially if provided with optimum growing conditions and an open, well-ventilated site. Leaf spots and insect pests can be a problem in some years and on some cultivars. Leaf spot is normally most damaging in July or early August, especially in a wet year. Uncontrolled leaf spots may result in defoliation that terminates further fruit development. Extended periods of wet weather favor disease, and during wet summers cover sprays from bloom to harvest may be needed to minimize losses from leaf spots and fruit rots (ripe rot, *Macrophoma* rot, and bitter rot). Dormant season vineyard sanitation reduces disease pressure. Most diseases overwinter on dead leaves and fruit on the vine and the ground. Removing or burning this material will reduce disease pressure and, in some years, will give satisfactory disease control.

Grape root borers are an important pest of muscadine vines. Aphids often occur on new shoot growth, but they seldom merit control. Grape berry moth and grape curculio occur sporadically. Japanese beetles may feed on foliage and flowers in early summer. Insects feeding on ripe fruit include green June beetles, as well as wasps, yellowjackets, and fire ants, which can pose a risk to pickers. The risk of infestation by spotted wing drosophila (SWD) just before and during harvest is not known, but the thick skins of muscadine grapes may provide a degree of tolerance to this pest.

PEST	MATERIAL OR ACTION	COMMENTS
DORMANT		
Dormant season sanitation helps reduce disease pressure. Fungal rot organisms of grapes overwinter on old vines and dried fruit on the vines and ground. Proper winter pruning aids in disease management. Hedge or hand prune vines, leaving only 3–4” stubs (spurs) of 1-year-old wood protruding from the main cordon or previous season’s wood. Selectively thin these spurs or spur clusters to space them approximately 4–6” along the cordon. As the vines age, remove some of the older spur clusters. Young vines (1–4 years old) require special attention to remove grape tendrils that wrap around the young cordons or arms. If not removed, these tendrils will girdle and kill newly trained arms. After the 3rd or 4th year, cordons become too thick for tendrils to wrap around them and this girdling ceases to be a threat. Late winter is the best time to prune muscadines in areas subject to winter injury.		
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes	Fire ants are a nuisance pest in vineyards or orchards. Ant baits or stakes are effective, but slow-acting, taking some 8 weeks to work. Apply baits in the spring and again 6–8 weeks before harvest. Apply on warm days when ants are active. Soil should be moist, but not wet.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	
EVERY 14 DAYS FROM BUD BREAK THROUGH BLOOM Do Not Apply Insecticides of Any Sort During Bloom Or Injury To Bees And Other Pollinators Is Likely To Occur		
Black Rot, Bitter Rot, Leaf Spots, Powdery Mildew	<i>captan</i> Captan 50WP	BLACK ROT susceptible varieties should be sprayed with fungicide every 14 days from the start of new growth until after bloom. This disease develops on the fruit during and just after bloom. Where ripe rot is a problem, use Captan 50WP. DO NOT SPRAY INSECTICIDE DURING BLOOM. Do not make more than 6 applications of Immunox at 2 oz/gal per season. Note, if wet weather persists or a vineyard has a history of rots, leaf spot, or powdery mildew, spray as needed.
	<i>copper hydroxide</i> Hi-Yield	
	<i>mancozeb</i> Bonide Mancozeb Flowable with Zinc	
	<i>myclobutanil</i> Immunox	

PEST	MATERIAL OR ACTION	COMMENTS
EVERY 14 DAYS FROM BUD BREAK THROUGH BLOOM (continued)		
Do Not Apply Insecticides of Any Sort During Bloom Or Injury To Bees And Other Pollinators Is Likely To Occur		
Aphids and/or Flea Beetles	<i>azadirachtin</i> Neemix 4.5	OMRI-approved.
	<i>cyfluthrin</i> Bayer Advanced Vegetable & Garden Insect	
	<i>esfenvalerate</i> Monterey Bug Buster II	<i>Esfenvalerate</i> and <i>cyfluthrin</i> are pyrethroids. They have activity against almost all commonly seen grape insect pests. Frequent use of pyrethroid insecticides may encourage mite and scale problems.
	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray Garden Tech Sevin-5 Dust	Aphids are typically cool-season, spring pests of muscadines. Natural enemies normally reduce aphid numbers as the weather warms. Treat if aphids are abundant and numerous new shoot tips or foliage are becoming malformed. Flea Beetles are foliage feeders that eat holes in the leaves. Less than 10% foliar injury is unlikely to be harmful. Treat if flea beetles are abundant and injury is evident. Grape flea beetles may also feed on developing buds; suggested treatment threshold is 5% damaged buds. Note, carbaryl is no longer the active ingredient in Sevin Insect Killer.
Aphids and/or Flea Beetles	<i>malathion</i> Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	
	<i>permethrin</i>	
COVER SPRAYS		
Cap fall, first cover and every 14 days from second cover until 6–8 weeks before harvest		
<p>Ripe rot <i>Colletotrichum sp.</i>, is one of the most difficult fungal pathogens to control on muscadine grapes. Most bronze-fruited cultivars are susceptible, while most purple-fruited muscadines are resistant. Sprays should begin at bloom or immediately following bloom (first cover). Ripe rot is most severe in wet harvest seasons and when fruit is left hanging too long on the vine. Timely harvest and rapid cooling of harvested fruit aids in control.</p>		
Black Rot, Ripe Rot, Macrophoma Rot	<i>captan</i> Captan 50WP	Captan may cause mild phytotoxicity to fruit if applied when conditions are cool and wet.
	<i>myclobutanil</i> Immunox	Do not make more than 6 applications of Immunox at 2 oz/gallon per season. Multiple applications should be rotated with <i>captan</i> .
<p>Cover spray insecticides are seldom needed in muscadines because of low to moderate insect pressure. Growers should rely on as-needed applications, while using the IPM approach of scouting frequently for insect damage, including detailed plant examination for insect or mite pests.</p> <p>Grape berry moth infestations are sporadic, but can be very damaging. This moth has several generations per season, beginning around bloom. In muscadines, grape berry moth is normally a mid-to-late season pest. Eggs are laid on the berry clusters, and young larvae enter berries at the stem end; their feeding, webbing and frass can damage multiple berries within a cluster. Spray promptly if infested clusters are seen or if a vineyard has a history of grape berry moth infestations.</p> <p>Grape curculio is a small weevil (snout beetle) that typically emerges in mid-to-late June. Grape curculio are occasional pests, though some vineyards may be infested annually. Grape curculio initially feeds on the underside of leaves in a shallow zigzag pattern before beginning to lay eggs in the berries. Spray if grape curculio are present or if either foliar or fruit injury are seen.</p> <p>Green June beetle and Japanese beetle populations can get out of hand rapidly. Moderate defoliation is seldom damaging, but in some years these insects can be found feeding on flowers or fruit, which can greatly reduce the crop. Do not allow these pests to feed heavily on and become abundant in blocks with ripe fruit. Beware of heavy emergence and migration to blocks with ripe fruit after rains. Multiple applications may be necessary to maintain control if populations are allowed to build up. Ripening fruit and aggregation pheromone may quickly attract “new” beetles to your vineyard after successful applications.</p> <p>Spider mites and others—Mites are capable of explosive population growth. Treat if more than 10 mites per leaf are found or if mites are present and leaves are webbed or bronzed. Drought and heavy crop load aggravate mite injury, especially early in a growing season. Two treatments at 1-week intervals may be needed if using a material that only kills adult mites. Brevipalpid mites (flat mites) cause russetting around leaf veins and at the stem end of berries, and may occasionally warrant control.</p>		

HOME ORCHARD MUSCADINE GRAPE DISEASE AND INSECT GUIDE

PEST	MATERIAL OR ACTION	COMMENTS
COVER SPRAYS (continued)		
Cap fall, first cover and every 14 days from second cover until 6–8 weeks before harvest		
<p>Stink bugs—The impact of stink bugs and other piercing/sucking insects causes some fruit to shrivel, spot or abort. If stink bugs and damage are evident, treat as needed.</p> <p>Grape root borers—Grape root borers are moths. Their larval or caterpillar stages feed on the inner bark of grape roots and crowns. Left unchecked, borers can kill grapevines. Borers tunnel inside vines at or below ground level, weakening or killing the vines. All grapes (bunch, muscadines, and vinifera) are susceptible. Mounding provides cultural control. Mounding uses layers of soil to make it more difficult for young larvae to reach the roots or adults to emerge. Use clean cultivation, and mound soil 1 foot high and 1½ feet out from the base of each vine. This practice will inhibit adult emergence from the soil when well timed; the time for this function will vary by location, early to mid-June for much of Georgia, so check with your county agent for the appropriate time for your location. It is equally important to knock these mounds back down between early November and late December. Mounding is an organically acceptable cultural practice. There are currently no insecticides labeled for homeowner use against grape root borers.</p>		
Treat As Needed for Japanese Beetle, Green June Beetle, Grape Berry Moth, Grape Curculio, and/or Fire Ants	<i>azadirachtin</i> Neemix 4.5	OMRI-approved.
	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray GardenTech Sevin-5 Dust	<i>Carbaryl</i> has some activity against grape berry moth, grape curculio, Japanese beetle, green June beetle, grasshoppers, leafhoppers, and stink bugs. Frequent use of <i>carbaryl</i> may encourage mite problems.
	<i>cyfluthrin</i> Bayer Advanced Vegetable & Garden Insect Spray	<i>Cyfluthrin</i> and <i>esfenvalerate</i> are pyrethroids. They have some activity against grape berry moth, grape curculio, Japanese beetle, green June beetle, grasshoppers, leafhoppers, and stink bugs. Frequent use of pyrethroids may encourage mite problems.
	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>malathion</i> Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> has some activity against grape berry moth, grape curculio, Japanese beetle, green June beetle, grasshoppers, leafhoppers, and stink bugs.
	<i>malathion + carbaryl</i> Bonide Fruit Tree Spray	
	<i>permethrin</i>	
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes	Apply in the spring and again 6–8 weeks pre-harvest. Apply when ants are actively foraging on warm sunny days when soil is moist but not saturated.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	
PRE-HARVEST SPRAYS		
Every 10–14 days during the last 6–8 weeks before harvest (Start July 1 on the Coastal Plain and July 10–14 in Middle Georgia)		
Bitter Rot, Macrophoma Rot, Ripe Rot, Angular Leaf Spot	<i>captan</i> Captan 50WD	<i>Captan</i> may be applied up to a day of harvest.
Wasps, Hornets, Yellow Jackets and Imported Fire Ants are attracted to ripening fruit. Monitor and treat as needed.	<i>azadirachtin</i> Neemix 4.5	Nothing is currently registered for these insects in grapes.
	<i>esfenvalerate</i>	
	<i>permethrin</i>	

HOME PEACH, PLUM, AND NECTARINE (STONE FRUIT) DISEASE AND INSECT GUIDE

Elizabeth Little, Extension Plant Pathologist
Brett Blaauw, Extension Entomologist

PEACH, PLUM, AND NECTARINE DISEASES

Peaches, plums, and nectarines are among the most difficult fruit crops to grow in the home garden. This pest management guide outlines disease and insect management programs that work well in most years. Sound, though often cosmetically marred fruit, can be grown by selective reduction of sprays during periods of dry weather as long as key sprays are applied for brown rot and plum curculio.

In addition to diseases of the fruit and foliage, peaches are subject to root and canker diseases, nematodes, and borers, which over a period of years can kill the trees. Good tree health begins with purchasing healthy trees from a reputable nursery. Plant on a suitable site, prune appropriately to avoid weak branches and open wounds, and pay attention to fertilization and water requirements. Healthy trees are better able to withstand all types of pest attacks.

Brown rot (*Monilinia fructicola*) is the most damaging fruit disease of peaches, plums, and nectarines. Management is dependent on use of effective fungicides. Brown rot is more severe in wet years, when up to 100% fruit loss occurs. Infected and mummified fruit left on the tree or on the ground, and to some extent stem cankers, are brown rot overwintering sites within the orchard. Removal of the old fruit at the end of the season and proper pruning during the dormant season will cut back on brown rot infections the following year. Brown rot can be active throughout the growing season, especially during wet periods. The most important time to apply fungicides to prevent fruit infections is during the 2–3 weeks prior to and through harvest. Bloom sprays are also important in preventing build-up of the disease during the season, especially in orchards with a history of brown rot problems.

Bacterial spot and leaf curl are leaf and fruit diseases that may cause problems in certain years or locations. Bacterial spot is sporadic and can be cultivar specific, but is typically worse on sandy sites. Select cultivars that are adapted to the East. Leaf curl is most common in the cooler, more northern areas of Georgia, but can occur in other areas in some years. If these diseases are found to be a problem, management can be improved with one or two dormant season applications of *lime sulfur* or coppers.

Scab is a fruit disease that causes superficial blemishes. Sprays for brown rot will also protect against scab. Sulfur can be used to control scab and brown rot from shuck split until 2 weeks prior to fruit ripening.

Black knot of plums is a serious problem on some plum cultivars. The black cankers grow and spread over time until the tree becomes weakened and unproductive. Wild black cherries and wild plums are sources for the fungus. If possible, remove wild cherries and plums from the vicinity of your orchard. Before planting, inspect trees for black knot cankers. If the disease is found within the orchard, prune out and burn any black knot infected twigs and branches promptly. If pruning does not control the problem, in-season fungicide sprays may be necessary, although brown rot sprays may provide some protection.

Note on Home Orchard Combo Sprays: Home orchard sprays are a mixture of fungicide and insecticide. These products cannot be used during bloom. It may be more convenient to buy the insecticide separate from the fungicide.

Note on Fungicide Usage: *Captan* plus *myclobutanil* should be tank-mixed and sprayed together whenever *myclobutanil* is used to reduce the risk of pathogen resistance to *myclobutanil*.

PEACH, PLUM, AND NECTARINE INSECT AND MITE PESTS

San Jose scale and white peach scale are serious, annual pests that can debilitate or kill stone fruits if not treated annually. Scale are small, sap-feeding insects that insert their syringe-like mouthparts into stems and fruit. Scale disperse during their first nymphal or crawler stage, thereafter only the adult males move about. A few days after hatching, scale crawlers settle down, insert their mouthparts into a stem or fruit and develop a protective cover, which protects them in a turtle shell-like fashion. Scale species are well camouflaged. **Peaches, plums, and nectarines should be treated twice during the dormant season (from leaf drop to first swollen fruit buds) every year with horticultural oil.** Oil concentrations of 1–3% are recommended. Reduce the rate of oil to 1% rate just before bloom. Do not apply oil when temperatures are expected to be higher than 70°F or lower than 32°F within 24 hours. Do not use horticultural oils

within 14 days of applying sulfur or sulfur-containing fungicides such as *captan*.

Fire ants are nuisance pests in orchards. Except for recently transplanted trees, which can be engulfed in mounds, fire ants cause almost no direct harm to fruit crops. However, many home orchardists will find it worthwhile to treat for fire ants annually. Ant baits provide the most effective control, but they require 4–8 weeks to reduce ant numbers. Ants must be actively foraging for baits to work well. Apply ant baits on warm, sunny days in the in the spring and again 6–8 weeks before harvest. Two applications will generally keep the orchard ant-free through harvest.

Flower thrips can cause skin-deep, cosmetic blemishes on plums, nectarines, and occasionally peaches. Silvering is a silvery stippling; russetting is a skin-deep tan to brown discoloration. Even when flower thrips are abundant enough to produce russetting or silvering, it is appropriate to consider potential injury to bees and other pollinators that may come with spraying. Broadleaf weeds can attract and host thrips, so flowering weeds (eg. white clover) in the orchard floor should be eliminated by use of herbicides or mowing.

Plant bugs, stink bugs, and leaffooted bugs (aka sucking bugs) are occasional pests of stone fruit. They feed by sucking liquefied cell contents through syringe-like mouthparts. While there are several native stink bugs found in the Southeast, a relatively new invasive species has also shown up in Georgia. The Brown marmorated stink bug (*Halyomorpha halys*) is an exotic stink bug that can cause major damage to tree fruit, especially peaches. The adults are approximately 5/8-inch long with a mottled brownish grey color. The next to last (4th) antennal segment has a white band and there are black and white bands on several of the abdominal segments. What is unique about brown marmorated stink bugs is that they commonly overwinter inside houses and other dwellings and emerge in early spring. Once they emerge from overwintering, they immediately move to feed on available hosts. Peaches are one of the preferred hosts of brown marmorated stink bugs with both the nymphs and adults feeding on the fruit. Early-season feeding causes fruit drop, which is normally of no consequence, as stone fruits set far more fruitlets than an un-thinned tree can mature without limb breakage and having very small fruit at harvest. Later in the season one sees catfacing, a scarring or deformation of the fruit, gumming, and corking. Sucking bug injury is more pronounced

in dry years. Sprays targeting plum curculio provide a helpful degree of sucking bug suppression. Regular mowing in and around the orchard prevents broadleaf winter annuals from blooming, which can help reduce plant bug and stink bug abundance. Removal or culling of fruit damaged or disfigured by sucking bugs is an easy way to improve fruit quality and fruit size.

Plum curculio is the worm in the wormy peach across the Southeast. Plum curculio are small weevils, or snout beetles, which feed on and lay their eggs in developing fruit. Apply plum curculio insecticides every 7–10 days from the shuck split/shuck off stage of fruit development for 3 applications. Thereafter, spray for plum curculio every 14–21 days until 14 days pre-harvest. Spraying again 14 days and 7 days pre-harvest should ensure acceptable to very good season-long control of plum curculio and it will minimize opportunistic pests such as green June beetles that are attracted to ripening fruit. More moderate spray regimes are feasible if the home orchardist is willing to monitor for plum curculio injury and accept a higher level of scarred and wormy fruit. Spraying for plum curculio at shuck split-shuck off, 10–14 days after shuck off, and pre harvest 7–14 days before picking begins, normally provides a dramatic reduction of wormy peaches, especially in early varieties that ripen in May. Results vary with minimalist plum curculio control programs unless one monitors the orchard 2–3 times a week to trigger additional sprays if signs of fruit-attacking injury are observed. Contact your county Extension office for details of plum curculio scouting.

Oriental fruit moth is a fruit-feeding caterpillar that damages stone fruit grown in Georgia's upper piedmont and mountain counties. Oriental fruit moth injury to Georgia peaches is most often confined to varieties ripening in July or later. Oriental fruit moth injury to stone fruit in lower piedmont and coastal plain counties is normally very light to non-existent.

Peachtree borer and lesser peachtree borer are moths; their larval stage caterpillars bore into and tunnel within the vascular, inner bark of stone fruit. Uncontrolled borer injury is debilitating. Borers must be controlled to prevent premature decline, and eventually death, of scaffold limbs and trees. In-season application of insecticides for plum curculio provides borer suppression. Post-harvest borer treatments are required to protect the trees from borers from harvest until temperatures drop in the fall. Borers are on the wing and laying eggs from April through October in Georgia.

PEST	MATERIAL OR ACTION	COMMENTS
DORMANT SEASON—From leaf drop in the fall until the earliest flower buds begin to swell.		
Bacterial Spot and Leaf Curl	<i>copper hydroxide</i> or <i>copper oxychloride</i> or <i>basic copper sulfate</i> Bonide Liquid Copper Dupont Kocide 3000 Monterey Liqui-Cop	<i>Coppers</i> have activity against bacterial spot. <i>Coppers</i> may damage foliage. Do not mix <i>copper hydroxide</i> with oils.
Scale	<i>dormant</i> and/or <i>verdant horticultural oils</i> Bonide All Seasons Horticultural & Dormant Spray Oil Hi-Yield Dormant Oil SunSpray Ultra-Fine Pest Oil (verdant)	Horticultural oils applied 2 times during each dormant season should provide good suppression of scale. Dormant oil applications also suppress European red mites and aphids. Horticultural oil sprays may be made from 95% leaf drop in the late fall to pink bud stage in the spring. However, horticultural oils can cause fruit finish injury and foliar injury, particularly when applied in warm to hot temperatures. Do not apply horticultural oils with or within 14 days of applying <i>sulfur</i> or <i>sulfur</i> -containing fungicides such as <i>captan</i> . Some horticultural oils are organic (OMRI-approved).
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes <i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	Fire ants may be a nuisance when working in orchards. Ant baits or stakes are effective, but slow-acting, taking some 8 weeks to work. Apply baits in the spring and again 6–8 weeks before harvest on warm days when ants are active. Soil should be moist, but not wet.
PRE-PINK BUD—Flower buds swollen with BB-sized pink of petals showing from swollen flower buds.		
Lesser Peachtree Borer	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray	<i>Carbaryl</i> has some activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leafhoppers, and stink bugs. Frequent use of <i>carbaryl</i> may encourage mite problems. Note, <i>carbaryl</i> is no longer the active ingredient in Sevin Insect Killer.
	<i>esfenvalerate</i>	Do not apply any pyrethroids until bloom is over.
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	Pre-pink bud (pre-bloom) application provides needed suppression of early emerging lesser peachtree borer moths. <i>Permethrin</i> and <i>esfenvalerate</i> are pyrethroids. They have activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leafhoppers, and stink bugs. Frequent use of pyrethroid insecticides often encourages mite and scale problems. Pyrethroid products are highly toxic to bees; do not use them in orchards from first bloom until the last petals have fallen.
PRE-BLOOM		
Thrips	<i>spinosad</i> Bonide Captain Jacks Deadbug Brew Natural Guard Spinosad	Treat for thrips before peaches, nectarines, or plums bloom. Treat for thrips only as-needed. Apply in the late afternoon or early evening after bees are no longer foraging.
BLOOM ***DO NOT USE INSECTICIDES DURING BLOOM***		
Blossom Blight Phase of Brown Rot	<i>captan</i>	One to two sprays, 7–10 days apart, depending on length of bloom and weather.
	<i>myclobutinil</i> Immunox	Do not make more than 6 applications of Immunox in a season. Immunox is best used during fruit ripening phase, should be rotated with <i>captan</i> . Note, important preventative spray for pre-harvest suppression of brown rot.
PETAL FALL, SHUCK SPLIT, AND SHUCK OFF		
Brown Rot, Scab, and Black Knot of Plum	<i>captan</i> Captan 50WP	Note, the shuck split spray is the most important spray for scab and for black knot of plum. Apply every 7–10 days for 3 sprays as needed based on presence of disease and weather (wet conditions).
	<i>chlorothalonil</i> Daconil	<i>Chlorothalonil</i> causes severe eye irritation and reentry into orchards is restricted for one week. If trees are close to children, pets, or houses, Daconil may be a poor choice.

HOME PEACH, PLUM, AND NECTARINE DISEASE AND INSECT GUIDE

PEST	MATERIAL OR ACTION	COMMENTS
PETAL FALL, SHUCK SPLIT, AND SHUCK OFF (continued)		
Plum Curculio, Plant Bugs, Lesser Peachtree Borer and/or Oriental Fruit Moth	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>malathion</i> Bonide Malathion Concentrate Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	Do not apply insecticide until bloom is over. Apply every 7–10 days for 3 sprays. <i>Malathion</i> has some activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leaffooted, and stink bugs. Use of <i>malathion</i> seldom induces secondary pests such as mites, scale, or aphids.
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	<i>Permethrin</i> and <i>esfenvalerate</i> are pyrethroids. They have activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leaffooted, and stink bugs. Frequent use of pyrethroid insecticides may encourage mite problems. Pyrethroid products are highly toxic to bees; do not use them in orchards from first bloom until the last petals have fallen.
SUMMER COVER		
Brown Rot and Scab	<i>captan</i> Captan 50WP	Apply every 14–21 days depending on weather. Captan should be applied in wet weather or if the green fruit rot stage of brown rot is seen. During dry summers, summer cover sprays may not be necessary. Alternating between <i>captan</i> and <i>sulfur</i> may work better than using only one. Apply every 14–21 days. <i>Sulfur</i> can burn foliage if temperatures are above 90°F.
	<i>sulfur</i> Bonide Liquid Sulfur, Safer Garden Fungicide, others	
Plum Curculio, Stink Bugs, Borers and/or Oriental Fruit Moth	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray	<i>Carbaryl</i> has some activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leaffooted, and stink bugs. Frequent use of <i>carbaryl</i> may encourage mite problems.
	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>malathion</i> Bonide Malathion Concentrate Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> has some activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leaffooted, and stink bugs. Use of <i>malathion</i> seldom induces secondary pests such as mites, scale or aphids.
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower Spectracide Bug Stop for Gardens	Apply every 14–21 days. <i>Permethrin</i> and <i>esfenvalerate</i> are pyrethroids. They have activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leaffooted, and stink bugs. Frequent use of pyrethroid insecticides may encourage mite and scale problems.
Thrips	<i>spinosad</i> Bonide Captain Jacks Deadbug Brew Natural Guard Spinosad	Treat for thrips only as-needed. Silvering typically occurs in central GA in early- to mid-May when thrips numbers peak. Apply in the late afternoon or early evening after bees are no longer foraging.
Fire Ants	<i>avermectin</i>	Apply in the spring and again 6–8 weeks pre-harvest. Apply when ants are actively foraging on warm sunny days when soil is moist but not saturated.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	
PRE-HARVEST		
Brown Rot	<i>captan</i> Captan 50WP	These are the most important preventative sprays Apply two sprays, one 14 days and the second 7 days pre-harvest. The brown rot fungus attacks the ripening fruit. Promptly remove and destroy any fruit that becomes infected. Do not make more than 6 applications of Immunox in a season.
	<i>myclobutanil</i> Immunox	
	<i>sulfur</i> Bonide Liquid Sulfur, Safer Garden Fungicide, others	

PEST	MATERIAL OR ACTION	COMMENTS
PRE-HARVEST (continued)		
Various Insects (check product label)	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray	<i>Carbaryl</i> has some activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leaffooted, and stink bugs, and pre-harvest pests such as green June beetles. Frequent use of <i>carbaryl</i> may encourage mite and scale problems.
	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>malathion</i> Bonide Malathion Concentrate Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> has some activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leaffooted, and stink bugs, and pre-harvest pests such as green June beetles. Use of <i>malathion</i> seldom induces secondary pests such as mites, scale or aphids.
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	Spray 14 days and 7 days before the anticipated first harvest in each variety. <i>Permethrin</i> and <i>esfenvalerate</i> are pyrethroids. They have activity against lesser peachtree borer, peachtree borer, plum curculio, Oriental fruit moth, grasshoppers, leaffooted, and stink bugs, and pre-harvest pests such as green June beetles. Frequent use of pyrethroid insecticides may encourage mite and scale problems.
POST-HARVEST		
Post-harvest sprays are very important for lesser peachtree borer and peachtree borer. Apply a dilute spray to near the point of run-off (1.5-2 gallons/tree) to the entire tree after the last fruit have been harvested and again in early September.		
Lesser Peachtree Borer and/or Peachtree Borer	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray	<i>Carbaryl</i> has some activity against lesser peachtree borer and peachtree borer. Frequent use of <i>carbaryl</i> may encourage mite and scale problems.
	<i>esfenvalerate</i> Monterey Bug Buster II	
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	<i>Permethrin</i> and <i>esfenvalerate</i> are pyrethroids. They have activity against lesser peachtree borer and peachtree borer. Frequent use of pyrethroid insecticides may encourage mite and scale problems.

HOME STRAWBERRY DISEASE AND INSECT GUIDE

Elizabeth Little, Extension Plant Pathologist
Brett Blaauw, Extension Entomologist

STRAWBERRY DISEASES

Strawberries are a cool season crop in Georgia that can be grown successfully on a small scale with minimal to no fungicides and other pesticides, making them a good choice for the home gardener. Strawberries can be grown as annuals or perennials. Root diseases may increase if strawberries are grown in the same spot for several years, although new plants can be grown away from older plants using the suckers. Good cultural practices that maximize plant health are the basis for preventing disease in strawberries. These practices include proper site selection, increasing the organic matter content of the soil, proper nutrition and pH, mulching, and end of season removal of old plant debris.

Anthracnose and botrytis blight (gray mold) are two common fruit diseases of strawberry. Anthracnose will

cause sunken dark spots on the fruit. Gray mold will cause a fuzzy gray growth and rot of the fruit, especially during and after wet weather. Both are managed by removing and destroying infected fruit.

Leaf spot (*Mycosphaerella fragariae*) may appear on the older leaves of strawberry at any time of the year but especially during wet weather. The disease is generally of minor concern.

Choosing a well-drained, sunny and open location will help protect against disease. The pathogens that cause these diseases survive between seasons in the soil and on old foliage. Removing and destroying old fruit and infected leaves and rotation every 1–2 years will cut down on problems the next year. A mulch layer (straw or plastic are the most common) applied during the dormant season will provide a barrier between the disease and the plants.

Hilling the plants will improve air circulation around the leaves and fruit. A rich, well-drained soil and balanced nutrition will allow the plants to thrive and resist diseases. All diseases, including root diseases, are encouraged by wet conditions. Drip irrigation and watering deeply but infrequently help to reduce disease. If good sanitation and other cultural practices are followed, disease impacts are often minimal. Fungicides may be used, especially if there has been a history of disease problems that cannot be managed with cultural practices.

STRAWBERRY INSECT AND MITE PESTS

Home garden strawberries have a number of pests, but only a few require insecticides, miticides, or fungicides in most years. Spotted wing fruit fly, a new, fruit-infesting pest of Asian origin, may require insecticide application(s) annually in many Georgia strawberry plantings. **Strawberry clippers, fire ants, and spider mites may also require insecticides or miticides.** Monitoring for these key pests should help home garden strawberry growers detect other insect and mite problems that may require as needed sprays.

Spotted wing drosophila (aka SWD or spotted wing fruit fly) is a serious, new exotic fruit-feeding pest that is widespread and damaging. SWD attacks sound berries as they begin to develop red color. Females lay eggs in ripening berries. Maggots are initially quite tiny, clear in color, and tapered on both ends. To control SWD, either: 1) spray 1 time per week from the time strawberries begin to redden. If heavy or frequent rains occur, spray 2 times per week; or 2) If maggot infested berries are found, pick and remove all reddening fruit, ripe fruit, and drops. Dispose of these fruits off-site or bury them. To regain control, apply insecticide 2 times per week for 2 weeks. Alternate application of *spinosad*, *malathion*, or a pyrethroid (*permethrin* or *esfenvalerate*) to control SWD. **Alternating insecticides reduces the risk of SWD resistance to insecticides.** UGA has a publication on organic management of spotted wing drosophila: <https://extension.uga.edu/publications/detail.html?number=B1497>.

Strawberry clipper is a serious occasional pest of strawberries and blackberries before and during bloom. Clippers are 1/8–1/4-inch-long snout beetles, or weevils. They have a copper-colored body, a black head and a long, curved snout. Adult clippers feed on and lay their eggs in unopened flower buds; then the female clips the stem below the bud. Buds dry out and either dangle or fall to the ground. The larval stage clipper, a grub, matures in

the clipped bud. There is one generation per year. Spray if you have a past history of strawberry clipper injury in your garden and you observe clipped flower buds.

Fire ants are aggressive, stinging ants that are highly problematic nuisance pests when weeding or picking berries. Except for individual plants engulfed in mounds, fire ants do no direct harm to strawberries. Ant baits provide the most effective control, but they work slowly, requiring 4–8 weeks to reduce ant numbers. Ants must be actively foraging for baits to work well. Apply ant baits annually on warm, sunny days in the spring and again 6–8 weeks before harvest. Two applications will typically keep strawberries ant-free through harvest.

Two-spotted spider mites (TSSM) are tiny, spider-like plant feeders that have either six or eight legs, depending on life stage. Spider mites rasp foliage and feed on sap that oozes from these small abrasions. Treat strawberries as-needed for spider mites when mites are present and 10% or more of leaves show tiny, speckled lesions that are cleared of pigment, or if webbing or bronzing are observed and mites are present. Mite-infested leaves often feel dirty and they appear duller in soft light than adjacent uninfested foliage. Mite control options for home garden strawberries are limited. Unfortunately, pyrethroid-treated strawberries often experience a rebound in mite numbers because pyrethroids also kill the spider mites' natural enemies. In home garden strawberries, spider mites can be managed with 1–2 applications of insecticidal soap or verdant horticultural oil. Both soaps and oils can lead to fruit finish problems, especially if applied as temperatures rise late in the harvest season. Horticultural oils also may cause fruit finish problems if applied within 14 days of applying *sulfur* or *sulfur*-containing products such as *captan*.

Sap beetles are best controlled with sanitation practices. Sap beetles are attracted to overripe fruit. Frequent, thorough harvest will minimize sap beetle problems. Sap beetles can also be attracted away from fields using bucket traps baited with overripe fruit or wheat bread dough.

Overripe berries and the contents of bait buckets should be disposed of off-site or buried 3 times per week. When really abundant, sap beetles can attack sound fruit that touch each other or the ground. Insecticide treatments should be used for sap beetles only if a thorough harvest and off-site disposal of all ripe and ripening berries has failed to provide control.

Slugs and snails are occasional pests that can be damaging, especially during periods of high rainfall. Baits

should be carefully placed adjacent to plants, just outside of strawberry beds. **Do not allow bait products to touch or otherwise contaminate fruit.**

Crickets, grasshoppers, or cutworms are occasional foliage, stem, or fruit pests of strawberries. They can attack strawberries season long. Cutworms are nocturnal, early season pests that may be very difficult to detect. Cutworm injury is more common shortly after plants are transplanted. Crickets and grasshoppers are easily seen.

Aphids are occasional, mostly springtime, pests of strawberries. Most aphids are 1/8–1/4-inch long, slow-moving, teardrop-shaped insects. Aphids have syringe-like mouthparts. They feed on plant sap and produce prodigious amounts of black sugary waste called honeydew, which serves as a growth media for sooty mold fungi. Aphid feeding can stunt or misshapen rapidly growing plant terminals. When severe, aphid feeding can leave plants stunted and unproductive. In most years, predators, parasites, and the onset of warmer weather will control aphid populations without any need for insecticide.

Plant bugs are occasional pests of strawberries. Plant bugs are 1/4-inch long, bronze-colored insects with a distinctive,

triangular-shaped area on the back. Immature plant bugs are smaller, wingless, bright green and aphid-like, though more active than aphids. Plant bugs and stink bugs, which are more common later in the season, are sucking bugs. They use their syringe-like mouthparts to feed on flower buds and developing fruit. When abundant, pre-bloom feeding may abort flower buds, feeding after fruit set can result in individual drupelets that remain white or turn brown and entire berries may become misshapen nubbins or button berries. Mowing to prevent broad-leaf winter annuals from budding or flowering nearby helps reduce plant bug abundance in strawberries. It is normally unnecessary to treat for plant bugs in strawberries. If plant bugs or stink bugs are present and injury is quite evident pre-bloom, consider applying insecticide, but wait until evening after bee foraging has stopped.

Flower thrips are tiny, less than 1/8 inch long, cigar-shaped insects. In dry springs they will occasionally cause flowers to abort or to produce misshapen berries. If flower thrips are very abundant and injury is very evident pre-bloom, it is difficult to treat for flower thrips without risking harm to bees.

PEST	MATERIAL OR ACTION	COMMENTS
FALL ESTABLISHMENT THROUGH DORMANT (PRE-BLOOM) SEASON		
Dormant season sanitation will reduce disease pressure most years. Strawberry leaf spots and Botrytis blight overwinter on old leaves and debris on the bed. Clipping old leaves, raking, and composting or destroying greatly aids in disease control.		
Spider Mites <i>Treat as-needed if spider mites and leaf stippling or webbing are present on >10% of leaves.</i>	<i>dormant and verdant</i> SunSpray Ultra-Fine Pest Oil (verdant)	Horticultural oils provide a degree of control for mites, aphids and other soft-bodied insect pests.
	<i>horticultural oils</i> Bonide All Seasons Horticultural & Dormant Spray Oil	Horticultural oils can cause fruit finish injury and foliar injury, particularly when applied in warm to hot temperatures. Do not apply horticultural oils with or within 14-days of applying <i>sulfur</i> or <i>sulfur</i> -containing fungicides such as <i>captan</i> . Some horticultural oils are organic (OMRI-approved).
	<i>insecticidal soaps</i> Safer 3-in-1 Garden Spray Safer Insect Killing Soap Bayer Advanced Natria Insecticidal Soap	Select soap products provide a degree of control for mites, aphids and other soft-bodied insect pests. Insecticidal soaps can cause fruit finish injury and foliar injury, particularly when applied in warm to hot temperatures. Some insecticidal soaps are organic (OMRI-approved).
Slugs and Snails	<i>carbaryl + metaldehyde baits</i> Deadline Bug Bait	Treat as needed, do not contaminate leaves or fruit with slug/snail control materials. Place bait products in the middles adjacent to, but not touching, foliage, or fruit.
	<i>metaldehyde baits</i> Hi-Yield Improved Slug & Snail Bait	
	<i>sulfur baits</i> Ortho Bug-Geta Snail and Slug Killer2	
	<i>iron phosphate + spinosad</i> Bonide Bug and Slug Killer	
	<i>iron phosphate baits</i> Bayer Advanced Dual Action Snail & Slug Killer Bait Sluggo Slug and Snail Bait	

HOME STRAWBERRY DISEASE AND INSECT GUIDE

PEST	MATERIAL OR ACTION	COMMENTS
NEW GROWTH —Begin as soon as new growth starts, and every 10–14 days until just before bloom.		
Leaf Spots, Anthracnose, Botrytis Blight (Gray Mold)	<i>captan</i> Captan 50WP	During periods of frequent rainfall, sprays at 7–10 day intervals may be necessary. Do not use more than 48 pounds of captan per acre per crop. Do not apply captan in combination with, immediately before or closely following oil sprays.
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes	Fire ants may be a nuisance. Ant baits or stakes are effective, but slow-acting, taking some 8 weeks to work. Apply baits in the spring and again 6–8 weeks before harvest. Apply on warm days when ants are active. Soil should be moist, but not wet.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	
PRE-BLOOM THROUGH BLOOM		
Strawberry Clipper, Plant Bugs, Crickets, Cutworms, and/or Aphids	<i>spinosad</i> Natural Guard Spinosad	<i>Spinosad</i> products have some activity against strawberry clipper and other early season pests. Most strawberry varieties bloom over an extended period. Insecticides should only be applied to berries still in bloom when clipper injury is severe. Apply needed insecticides in the evening after bee foraging has ended for the day. Some <i>spinosad</i> products are organic (OMRI-approved).
	<i>malathion</i> Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	<i>Malathion</i> products have some activity against strawberry clipper and other early season pests. Most strawberry varieties bloom over an extended period. Insecticides should only be applied to berries still in bloom when clipper injury is severe. Apply needed insecticides in the evening after bee foraging has ended for the day.
10% BLOOM		
Leaf Spots, Botrytis Blight (Gray Mold), and Other Fruit Rots	<i>captan</i> Captan 50WP	During periods of frequent rainfall, sprays at 7–10 day intervals may be necessary. Do not apply <i>captan</i> in combination with, immediately before, or closely following oil sprays.
FULL BLOOM — Critical time for Botrytis (Gray mold) control begins here		
Leaf Spots, Botrytis Blight (Gray Mold), and Other Fruit Rots	<i>captan</i> Captan 50WP	During periods of frequent rainfall, sprays at 7–10 day intervals may be necessary.
EVERY 10–14 DAYS FROM BLOOM UNTIL HARVEST		
Leaf Spots, Botrytis Blight (Gray Mold), And Other Fruit Rots	<i>captan</i> Captan 50WP	Under severe gray mold conditions (frequent rainfall) and if botrytis has been a problem, apply immediately after picking at 7–10 day intervals. When weather conditions are dry, fungicides are often not necessary. Remove and destroy any infected fruit. Do not apply captan in combination with, immediately before, or closely following oil sprays.
Fire Ants	<i>avermectin</i> Raid Outdoor Ant Stakes	Annual application(s) of bait product should provide good fire ant suppression. Apply in the spring and again 6–8 weeks pre-harvest. Apply when ants are actively foraging on warm sunny days when soil is moist but not saturated.
	<i>spinosad</i> Ferti-Lome Come and Get It Fire Ant Killer	
Spotted Wing Fruit Fly (SWD), Spider Mites, Plant Bugs, Grasshoppers, and/or Sap Beetles	<i>malathion</i> Spectracide Malathion Insect Spray Ortho MAX Malathion Insect Spray Concentrate	Treat weekly for SWD from the onset of red fruit through harvest. Treat for other pests if damage and pests are evident. <i>Malathion</i> has activity against spotted wing fruit fly, grasshoppers, and caterpillars. Use of <i>malathion</i> seldom induces secondary pests such as mites or aphids.
	<i>spinosad</i> Natural Guard Spinosad	<i>Spinosad</i> products have activity against spotted wing fruit fly, grasshoppers, and caterpillars. Some <i>spinosad</i> products are organic (OMRI-approved).
	<i>permethrin</i> Bonide 8 Vegetable, Fruit and Flower	<i>Permethrin</i> has activity against spotted wing fruit fly, caterpillars, and grasshoppers. Frequent use of pyrethroid insecticides may encourage mite problems. Do not apply any pyrethroids until bloom is over.
	<i>carbaryl</i> Ferti-lome Liquid Carbaryl Garden Spray	<i>Carbaryl</i> has activity against strawberry clipper, grasshoppers, and caterpillars. Frequent use of <i>carbaryl</i> may encourage mite problems. Note, <i>carbaryl</i> is no longer the active ingredient of Sevin Insect Killer.

PEST	MATERIAL OR ACTION	COMMENTS
EVERY 10–14 DAYS FROM BLOOM UNTIL HARVEST (continued)		
Spotted Wing Fruit Fly (SWD), Spider Mites, Plant Bugs, Grasshoppers, and/or Sap Beetles <i>(continued)</i>	<i>dormant and verdant horticultural oils</i> SunSpray Ultra-Fine Pest Oil (verdant) Bonide All Seasons Horticultural & Dormant Spray Oil	Horticultural oils provide a degree of control for mites, aphids, and other soft-bodied insect pests. However, horticultural oils can cause fruit finish injury and foliar injury, particularly when applied in warm to hot temperatures. Do not apply horticultural oils with or within 14 days of applying <i>sulfur</i> or <i>sulfur</i> -containing fungicides such as <i>captan</i> . Some horticultural oils are organic (OMRI-approved).
	<i>insecticidal soaps</i> Safer 3-in-1 Garden Spray Safer Insect Killing Soap Bayer Advanced Natria Insecticidal Soap	Select soap products provide a degree of control for mites, aphids, and other soft-bodied insect pests. However, insecticidal soaps can cause fruit finish injury and foliar injury, particularly when applied in warm to hot temperatures. Some insecticidal soaps are organic (OMRI-approved).

HOME FRUIT INSECTICIDE EFFECTIVENESS CHART

Brett Blaauw and Dean Kemp, Entomology

This list is not comprehensive. It offers pest-specific performance ratings that have been derived from in-

orchard trials, observations in commercial fruit, or based on active ingredient.

INSECTICIDAL ACTIVE INGREDIENT	PRODUCT NAME	LABELED CROPS	Internal Fruit-Feeding Caterpillars ¹	Internal Fruit-Feeding Beetles ²	Plant Bugs/Stink Bugs	Leaf Feeding Caterpillars	Leaf Feeding Beetles	Mites	Scales	Borers	Aphids, Mealybugs, Leafhoppers
NEONICOTINOIDS											
<i>imidacloprid</i>	BioAdvanced Fruit, Citrus & Vegetable Insect Control	apple, pear, grape, peach, plum, nectarine	P	P–F	G	F	F–G	?	F	P	E
<i>imidacloprid</i>	Hi-Yield Systemic Insect Spray	apple, pear, peach, plum	P	P–F	G	F	F–G	?	F	P	E
<i>imidacloprid</i>	Bonide Systemic Insect Spray	apple, pear, peach, plum	P	P–F	G	F	F–G	?	F	P	E
PYRETHROIDS											
<i>bifenthrin</i>	Ferti-Lome Broad Spectrum Insecticide	pear, bramble, strawberry	E	G	G	E	G–E	P	NC	F	F–G
<i>bifenthrin + zeta-cypermethrin</i>	Ortho Bug B Gon Insect Killer for Lawns & Gardens	pear, bramble	E	G	F–G	E	G–E	F–G	NC	F	F–G
<i>cyfluthrin</i>	BioAdvanced Vegetable & Garden Insect Spray	Grape	E	G	G	E	G–E	P	NC	F	F–G
<i>esfenvalerate</i>	Monterey Bug Buster II	apple, pear, blueberry, grape, peach, plum, nectarine	E	G	F–G	E	G–E	NC	NC	F	F–G

1 codling moths, Oriental fruit moths, etc.

2 plum curculio, strawberry weevil, etc.

Insect/Mite Ratings: ?—unknown, NC—no control, P—poor, F—fair, G—good, E—excellent, N/A—not applicable

Always read and follow the pesticide label before application.

HOME FRUIT INSECTICIDE EFFECTIVENESS CHART

INSECTICIDAL ACTIVE INGREDIENT	PRODUCT NAME	LABELLED CROPS	Internal Fruit-Feeding Caterpillars ¹	Internal Fruit-Feeding Beetles ²	Plant Bugs/Stink Bugs	Leaf Feeding Caterpillars	Leaf Feeding Beetles	Mites	Scales	Borers	Aphids, Mealybugs, Leafhoppers
PYRETHROIDS (continued)											
<i>gamma-cyhalothrin</i>	Spectracide Triazicide Insect Killer Concentrate for Lawn & Landscape	apple, pear, peach, plum, nectarine	E	G	F-G	E	G-E	NC	NC	F	F-G
<i>permethrin</i>	Bonide Eight Vegetable, Fruit & Flower	apple, pear, blueberry, bramble, peach, strawberry	G	F	F-G	E	G-E	NC	NC	F	F-G
<i>permethrin</i>	Hi-Yield Indoor/Outdoor Broad Use Insecticide	apple, pear, blueberry, bramble, peach, strawberry	G	F	F-G	E	G-E	NC	NC	F	F-G
<i>zeta-cypermethrin</i>	GardenTech Sevin Insect Killer (Note active ingredient change)	apple, pear, blueberry, bramble, grape, peach, plum, nectarine	G	G	F	E	G	F	NC	F	F-G
ORGANOPHOSPHATES											
<i>malathion</i>	Bonide Malathion concentrate	apple, pear, blueberry, bramble, peach	G	F	F	G	G	P	P	F	F-G
<i>malathion</i>	Hi-Yield 55% Malathion	pear, peach	G	F	F	G	G	P	P	F	F-G
<i>malathion</i>	Ortho MAX Malathion Insect Spray Concentrate	pear, grape, peach, strawberry	G	F	F	G	G	P	P	F	F-G
<i>malathion</i>	Southern Ag Malathion 50%	pear, grape, peach, strawberry	G	F	F	G	G	P	P	F	F-G
<i>malathion</i>	Spectracide Malathion Insect Spray	grape, peach, strawberry	G	F	F	G	G	P	P	F	F-G
<i>captan</i> * + <i>malathion</i> + <i>carbaryl</i>	Bonide Fruit Tree Spray	apple, grape, peach, strawberry	G	F	F	G	G-E	P	P	P	F-G
CARBAMATES											
<i>carbaryl</i>	Ferti-lome Liquid Carbaryl Garden Spray	apple, blueberry, bramble, grape, peach, plum, nectarine, strawberry	G	F	F	G	G-E	NC	P	F	P
<i>carbaryl</i>	GardenTech Sevin-5 Ready-To-Use 5% Dust	blueberry, bramble, grape, strawberry	G	F	F	G	G-E	NC	P	F	P
<i>captan</i> * + <i>malathion</i> + <i>carbaryl</i>	Bonide Fruit Tree Spray	apple, grape, peach, strawberry	G	F	F	G	G-E	P	P	P	P

* fungicide

1 codling moths, Oriental fruit moths, etc.

2 plum curculio, strawberry weevil, etc.

Insect/Mite Ratings: ?—unknown, NC—no control, P—poor, F—fair, G—good, E—excellent, N/A—not applicable

INSECTICIDAL ACTIVE INGREDIENT	PRODUCT NAME	LABELED CROPS	Internal Fruit-Feeding Caterpillars ¹	Internal Fruit-Feeding Beetles ²	Plant Bugs/Stink Bugs	Leaf Feeding Caterpillars	Leaf Feeding Beetles	Mites	Scales	Borers	Aphids, Mealybugs, Leafhoppers
OILS											
<i>horticultural oil</i>	Bonide All Seasons Horticultural & Dormant Spray Oil	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	NC	NC	P	P	P	P-G	G	P	F-G
<i>horticultural oil</i>	Hi-Yield Dormant Spray	apple, pear, peach, plum, nectarine,	NC	NC	P	P	P	P-G	G	P	F-G
<i>refined horticultural oil</i>	SunSpray Ultra-Fine Pest Oil	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	NC	NC	P	P	P	P-G	G	P	F-G
SOAPS											
<i>insecticidal soap + pyrethrin</i>	Safer Tomato and Vegetable Insect Killer	apple, pear, bramble, grape, peach, plum, nectarine, strawberry	P	P	P	P-F	P-F	P	P	P	F-G
<i>potassium salts of fatty acids</i>	Earth-tone Insecticidal Soap	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	P	NC	?	?	?	?	?	?	F
<i>potassium salts of fatty acids</i>	Bayer Advanced Natria Insecticidal Soap	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	P	NC	?	?	?	?	?	?	F
<i>potassium salts of fatty acids</i>	Miracle-Gro Nature's Care Insecticidal Soap	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	P	NC	?	?	?	?	?	?	F
<i>potassium salts of fatty acids + sulfur</i>	Safer 3-in-1 Garden Spray	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	P	NC	?	?	?	?	?	?	F
<i>potassium salts of fatty acids</i>	Safer Insect Killing Soap	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	P	NC	?	?	?	?	?	?	F

1 codling moths, Oriental fruit moths, etc.

2 plum curculio, strawberry weevil, etc.

Insect/Mite Ratings: ?—unknown, NC—no control, P—poor, F— fair, G—good, E—excellent, N/A—not applicable

HOME FRUIT INSECTICIDE EFFECTIVENESS CHART

INSECTICIDAL ACTIVE INGREDIENT	PRODUCT NAME	LABELED CROPS	Internal Fruit-Feeding Caterpillars ¹	Internal Fruit-Feeding Beetles ²	Plant Bugs/Stink Bugs	Leaf Feeding Caterpillars	Leaf Feeding Beetles	Mites	Scales	Borers	Aphids, Mealybugs, Leafhoppers
NATURAL PRODUCT DERIVATIVES (Many of these naturally derived active ingredients for EPA's "Approved for Organic Gardening" or OMRI listing)											
<i>chemical from chrysanthemum flowers</i>	Pyrethrin products	See product label	P	P	P	F	F	P	P	P	F
<i>diatomaceous earth</i>	Diatomaceous earth	See product label	P	NC	P	P	P	F	P	P	F-G
<i>iron phosphate + spinosad</i>	Bonide Bug and Slug Killer	apple, pear, blueberry, grape, peach, plum, strawberry	P	P	P	G	G	F	F	P	F-G
<i>kaolin clay</i>	Gardens Alive Surround at Home Crop Protectant	See product label	P	P	F	P-F	F-G	P	P	P	P
<i>leaf extracts from the neem tree</i>	Azadirachtin	See product label	P	P	P	P-F	F	F	F	P	F-G
<i>leaf extracts from the neem tree</i>	Certis USA Neemix 4.5 (azadirachtin)	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	P	P	P	P-F	F	F	F	P	F-G
<i>leaf extracts from the neem tree + neem oil</i>	Safer Brand BioNEEM Insecticide	apple, pear, peach, plum	P	P	P	P-F	F	F	F	P	F-G
<i>neem + pyrethrin</i>	Ferti-lome Triple Action Plus	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	P	P	P	P-F	F	F	F	P	F
<i>neem oil</i>	Natural Guard Neem	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	F	P	P	P	F	F	F	P	P-F
<i>oil extracted from neem tree nuts</i>	Neem	See product label	F	P	P	P-F	P-F	F	F	P	P-F
<i>oil extracted from neem tree nuts</i>	Bayer Advanced Natria Neem Oil	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	F	P	P	P-F	P-F	F	F	P	P-F
<i>oil extracted from neem tree nuts</i>	Bonide Neem Oil	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	F	P	P	P-F	P-F	F	F	P	P-F

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INSECTICIDAL ACTIVE INGREDIENT	PRODUCT NAME	LABELED CROPS	Internal Fruit-Feeding Caterpillars ¹	Internal Fruit-Feeding Beetles ²	Plant Bugs/Stink Bugs	Leaf Feeding Caterpillars	Leaf Feeding Beetles	Mites	Scales	Borers	Aphids, Mealybugs, Leafhoppers
NATURAL PRODUCT DERIVATIVES (continued) (Many of these naturally derived active ingredients for EPA's "Approved for Organic Gardening" or OMRI listing)											
<i>pyrethrin</i>	Bonide Garden Dust	apple, pear, grape, peach, nectarine	G	F	F-G	E	G-E	NC	NC	F	P-F
<i>pyrethrins + piperonyl butoxide</i>	Garden Safe Multi-Purpose Garden Insect Killer	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	F	P	P	P-F	P-F	P	P	NC	P-F
<i>pyrethrins + piperonyl butoxide + neem oil</i>	Ortho Tree & Shrub Fruit Tree Spray	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	F	P	P	P-F	P-F	P-F	P-F	NC	P-F
<i>pyrethrins + piperonyl butoxide + neem oil</i>	Ferti-Lome Fruit Tree Spray	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	F	P	P	P-F	P-F	P-F	P-F	NC	P-F
<i>rosemary + peppermint + thyme + clove oils</i>	EcoSmart Organic Garden Insect Killer	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	P	NC	P	?	?	?	?	?	P
<i>sesame oil</i>	Organocide Organic Insecticide and Fungicide	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	P	NC	?	?	?	?	?	?	?
<i>spinosad</i>	Bonide Captain Jacks Deadbug Brew	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	F	P	P	G	G	F	F-P	P	P-F
<i>spinosad</i>	Ferti-Lome Come and Get It Fire Ant Killer	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>spinosad</i>	Natural Guard Spinosad	apple, pear, blueberry, grape, peach, plum, nectarine, strawberry	F	P	P	G	G	F	F-P	P	P-F

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HOME FRUIT INSECTICIDE EFFECTIVENESS CHART

INSECTICIDAL ACTIVE INGREDIENT	PRODUCT NAME	LABELED CROPS	Internal Fruit-Feeding Caterpillars ¹	Internal Fruit-Feeding Beetles ²	Plant Bugs/Stink Bugs	Leaf Feeding Caterpillars	Leaf Feeding Beetles	Mites	Scales	Borers	Aphids, Mealybugs, Leafhoppers
BIOLOGICALS											
<i>Bacillus thuringiensis subspecies kurstaki</i>	Garden Safe Bt Worm & Caterpillar Killer	See product label	F	NC	NC	G	NC	NC	NC	P	NC
<i>Heterorhabditis bacteriophora</i> nematodes	Arbico Organics NemaSeek	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	NC	NC	NC	NC	Effective on in-ground life stages of Japanese beetles if soil is moist	NC	NC	?	NC
<i>Paenibacillus popilliae</i> bacterium	Arbico Organics Milky Spore powder	apple, pear, blueberry, bramble, grape, peach, plum, nectarine, strawberry	NC	NC	NC	NC	Effective on in-ground life stages of Japanese beetles	NC	NC	NC	NC
<i>Steinernema riobrave</i> nematodes	Biovector 355	See product label	P	Effective on in-ground life stages of plum curculio if soil is kept moist	NC	NC	NCN	NC	NC	NC	NC
<i>Steinernema carpocapsae</i> nematodes	Arbico Organics NemAttack Koppert Capsanem SE Insectaries, Perry, GA 478-988-9412	See product label	P	NC	NC	NC	NC	NC	NC	Effective on in-ground stages of peach tree borer if soil is kept moist	NC

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