

2005 Southeast Regional Brambles Integrated Management Guide

Commodity Editor

Phil Brannen (University of Georgia)

Section Editors

Pathology; Guido Schnabel (Clemson University)

Entomology; Dan Horton (University of Georgia)

Weed Science; Wayne Mitchem and David Monks (North Carolina State University)

Vertebrate Management; David Lockwood (University of Tennessee)

Culture; Gina Fernandez (North Carolina State University)

Pesticide Stewardship and Safety; Bob Bellinger (Clemson University)

and Paul Guillebeau (University of Georgia)

Senior Editors

Phil Brannen (University of Georgia)

Powell Smith (Clemson University)

Contributions were also made by Barbara Smith (USDA/ARS Small Fruit Res. Station, Poplarville, MS), Steve Bost (University of Tennessee), Gerard Krewer (University of Georgia), Turner Sutton (North Carolina State University), James Jacobs (University of Georgia) and Ken Sorenson (North Carolina State University).

Recommendations are based on information from the manufacturer's label and performance data from research and extension field tests.

Because environmental conditions and grower application methods vary widely, suggested use does not imply that performance of the pesticide will always conform to the safety and pest control standards indicated by experimental data.

This publication is intended for use only as a guide. Specific rates and applications methods are on the pesticide label, and these are subject to change at any time. Always refer to and read the pesticide label before making any application! The pesticide label supersedes any information contained in this guide, and it is the legal document referenced for application standards.

Blackberry and Raspberry Integrated Management Guide

Pre-Transplant and Transplant Operations

Blackberries and raspberry terminology – In general, though there are exceptions, diseases of raspberries are the same as those of blackberries, and control measures are the same unless otherwise indicated. Flowers and fruit develop on the second year canes, the floricanes. A one-year-old cane is called a primocane. Blackberry varieties may be erect, semi-erect, or procumbent.

General fungicide resistance management recommendations:

- limit the number of times fungicides of the same class are applied in one year. Rovral is a dicarboximide and Pristine, Cabrio, and Abound represent strobilurins, as examples of fungicide classes (see the Fungicide Classes chart for additional help relative resistance management programs).
- tank mix benzimidazole or dicarboximides with a broad spectrum fungicide such as Captan.
- apply fungicides of the same class in a block of sprays (2-3 sprays), then alternate to a fungicide of a different class in the next block of sprays.

Nematodes – Little is known about nematodes and brambles in the Southeast, but there are at least three reasons why nematodes can be potentially problematic for brambles: (1) they can directly destroy roots, resulting in decreased uptake of nutrients and water, as well as increasing root rot diseases, (2) nematode damage can increase crown gall, caused by a root and crown-infecting bacterium, and (3) many nematodes spread bramble viruses. September samples give the best assessments of root-knot, root-lesion, dagger and other significant nematodes of brambles, and all potential sites should be sampled well ahead of land preparation. Following fumigation, a two-month period is often required before planting. Relatively warm conditions are also required for effective fumigation. Therefore, it is best to fumigate by late October to late November, depending on location.

Viruses – Bramble viruses are particularly problematic. Once viruses are introduced in a planting, there is no remedy, save for rapid removal of symptomatic plants. Since viruses can be introduced through propagation, clean planting stock is essential. Tissue-cultured plants are more likely to be free of viruses and crown gall. Although it does not guarantee virus-free plants, use of tissue-cultured plants is highly recommended for the Southeast. Destruction of wild blackberries within 100-200 yards of a commercial planting may be of value to reduce potential introduction of viruses and other pathogens from the native populations. Nematode control, especially of dagger nematode, is essential to prevent virus spread; even low levels of dagger are dangerous.

Crown gall – All brambles can be affected. Canker-like growths or galls 0.25-2.5 inches in diameter develop on roots and stems; galls are first greenish-white, turning tan to brown, and then black. Use of tissue-cultured plants will also help to prevent introduction of crown-gall infected plants. As additional insurance against this disease, dip root cuttings in Galltrol or Nogall suspensions. Galltrol contains *Agrobacterium radiobacter* strain K84 and should result in significant reduction in disease. The new strain found in Nogall, K1026, is a derivative of strain K84. One 100g pack of Nogall, when mixed into slurry with 1 gallon of water, treats up to 2,000 cuttings. One container can treat as many as 10,000 root pieces. This biological control bacterium has not controlled all strains of the crown gall bacterium; local data on brambles is not currently available. All brambles are very susceptible, and the causal bacteria persist in soil. Wounds are required for infection, so every effort should be made to avoid wounding roots and lower stems. Allow root pieces to heal prior to planting. Prune when 2-3 days of open weather is expected. Avoid cultivation by using herbicides for weed control, but also avoid herbicide burn of stems.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Nematodes	1,3-dichloropropene (Telone II)	27-35 gallons	+++++	5 days		Suggested pre-plant interval: 4 to 8 weeks, longer when dissipation is slow.

Blackberry and Raspberry (continued)

Pre-Transplant and Transplant Operations (continued)

Fumigation with Telone – Telone II is highly toxic. Carefully abide by all label precautions, and review the label before each application. Telone II may be used when soil temperatures are from 40°-80°F at the prescribed injection depth (a minimum of 12 inches). Thorough soil preparation is required, and soil moisture is a critical consideration. If it is too dry, the soil surface will not seal enough to prevent premature dissipation. If the soil is too wet, the product is less effective because it will not move as well in the soil, which will decrease product effectiveness. Excessive soil moisture can also prolong desired dissipation from the soil, which forces delay of planting to avoid phytotoxicity. Soil temperatures of 40°-80°F are required for use of Telone. However, the product is more active at the upper end of this temperature range. In the Southeast, applications should generally be made in the Fall prior to mid-November. October soil temperatures often provide the best opportunity for efficacy, due to adequate soil temperatures. Plants can be easily killed by Telone if planting takes place too soon after application. At a minimum, the 27 GPA rate would require four weeks from application to planting, and the 35 GPA rate would require five weeks. If soils are wet or they have a clay component, dissipation will be much slower. Plan for at least 6-8 weeks between fumigation and planting. Even more time may be necessary. Before planting, use a post-hole digger or shovel to smell of the soil at the full depth of injection; if the almond-like odor of Telone is present, dissipation is not complete, and it is too early to plant. Cultivation, at a depth not to exceed the depth of Telone application, with subsoil shanks, a middle buster or other implements, will hasten dissipation of Telone. More than one cultivation may be required to get Telone out of the ground pre-plant.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Nematodes (continued)	metam sodium (Vapam, Sectagon II, Busan 1020)	75 gallons	+++	48 hours*		*If tarps are used for the application, non-handler entry is prohibited while tarps are being removed. Soil temperature must be 40°-90°F for activity. Soil moisture must be adequate, and has to be thoroughly cultivated prior to application. On well-drained soils with light to medium texture planting can begin 14-21 days after treatment. If soils are heavy or high in organic matter, or if the soils remain wet and/or cold (<60°F) following the application, a minimum interval of 21 days is necessary. Dissipation can be increased through cultivation. Plan for at least a four week interval between treatment and planting. More time may be required.
Crown gall	<i>Agrobacterium tumefaciens</i> strain K-84 (Galltrol)	1 plate/1-5 gal	++	0 days	not listed	Usually applied as a dip to root cuttings. This biological control bacterium has not controlled all strains of the crown gall bacterium. All brambles are susceptible. Avoid wounding of roots during planting because they are required for infection.

Blackberry and Raspberry (continued)

Pre-Transplant and Transplant Operations (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Crown gall (continued)	<i>Agrobacterium radiobacter</i> strain K1026 (Nogall)	100g/gal	++	0 days	0 days	One 100 g pack of Nogall, when mixed into a slurry with 1 gallon of water, treats up to 4,000 seeds, up to 1,000 seedlings and, depending on their size, 100-2,000 cuttings.

Dormant (prior to budbreak)

Cane and leaf rust and anthracnose – These can be reduced by dormant-season sanitation. Wild blackberries near commercial plantings should be destroyed. Bramble plantings should be pruned to remove old floricanes and any new canes that show signs of disease or insect injury. Remove and burn or bury prunings. Though difficult to accomplish, removal of old floricanes is essential to good sanitation in a bramble planting.

Raspberry crown borer and red-necked cane borer – Infested canes should be either removed from the site or burned. In some blocks, cultural controls will need to be augmented with insecticides later in the production cycle.

Delayed Dormant (swollen buds) to Green Tip

Anthracnose – Most conspicuous on canes: reddish purple spots appear on primocanes in the spring; later, centers turn gray with raised purple margins. Still later, lesions dry out, crack, and can girdle cane. Leaves, flowers, and fruit may be affected. Hosts affected: black raspberry (very susceptible), red raspberry (susceptible), blackberry (tolerant). Among blackberries, thorny blackberries are more susceptible than thornless. Erect blackberries are more susceptible than procumbent. Erect blackberry varieties listed from more resistant to moderately susceptible are Cherokee, Cheyenne, Comanche, Shawnee, Navaho, Arapaho, Choctaw, Womack, Raven, Brison, Brazos, Rosborough. For Cherokee, dormant sprays have been adequate in most plantings but cover sprays and post-harvest sprays may be used as deemed necessary. Disease control: Prompt removal and destruction of the old floricanes (maybe even primocanes in some cases) after harvest is the key to blackberry disease control. Also, destruction of nearby hosts (wild blackberries) will reduce disease pressure. All steps possible should be taken to improve air circulation within a planting, to allow faster drying of foliage and canes (e.g., weed control, removal of suckers, thinning). Timing of fungicide sprays is critical. Spray at green tip (when plants break dormancy) to the point at which no more than 3/4" green tissue has been formed. Additional applications have been recommended when primocanes are 6" tall and again in 14 day intervals through harvest.

Spur blight – Hosts affected: black and red raspberry. Symptoms: Brown, V-shaped lesions progressing from leaf margins. Infection spreads from leaf to cane, causing a dark chestnut brown lesion centered on the leaf node. Buds at affected nodes fail to grow or produce weak laterals. Disease control: Spur blight is only a problem in certain regions of the southeastern United States. Disease diagnosis is recommended before initiating a fungicide-based control program.

Blackberry and Raspberry (continued)

Delayed Dormant (swollen buds) to Green Tip (continued)

Septoria leaf spot – Hosts affected: blackberry; raspberries are mostly tolerant. Spots with whitish centers and brown borders on leaves and canes; infected leaves drop off. Disease control: Remove floricanes as soon as the fruiting season is complete. Sprays applied for anthracnose, Botrytis gray mold, double blossom, and fruit rots will prevent Septoria infections. Loss impact usually is relatively minor. Heavily infected plants are not as vital, produce less fruit, and may be more susceptible to cold injury. Again, the problem is generally more serious on raspberries.

Raspberry crown borer – Larvae overwinter in silken hibernacula on the roots and crown. In the spring, larvae leave hibernacula to bore into the roots and the crown. The cultural control of **roguing infested canes is very important. Remove and destroy infested canes whenever they are found. In blocks with a history of raspberry crown borer infestations, delayed dormant insecticide applications**, applied as-needed, provide an insecticide barrier to prevent raspberry crown borer larvae from boring into crowns as they emerge from their hibernacula.

Fire ants – Fire ants are a nuisance pest. Extinguish Professional Fire Ant Bait is labeled for use on crop land. Apply on a warm sunny day when soil moisture is good. Allow 6 to 8 weeks for control. Two applications, spring and fall, work best, but are costly.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Anthracnose Cane blight Spur blight	copper-based products	See label	+	24 hrs	See label	Multiple copper-based materials are available, including copper hydroxide, copper sulfate and others. Apply prior to 3/4 inch shoot stage to avoid leaf burn. For raspberries only: Copper can cause phytotoxicity on black raspberry cultivars if used with Aliette. It is also an occasional problem on red raspberries.
	calcium polysulfide (Lime Sulfur)	6-16 gal (highly variable; check specific product label)	++	48 hrs	See label	Apply lime-sulfur at delayed dormant, but before shoots are 3/4-inch long. Lime sulfur will 'burn' applicators as well as the plant. Any exposed green tissue will likely be burned. A minimum of 200 gallons of diluted spray is recommended per acre. Follow specific label directions for dilutions, and never use in the undiluted form.
Raspberry crown borer	esfenvalerate (Asana XL)	9.6 fl ozs	+++	12 hrs	7 days	Use sufficient spray volume to assure good coverage of the lower portions of canes and crowns.
	malathion (Malathion 57EC)	3 pts	++	12 hrs	1 day	Use sufficient spray volume to assure good coverage of the lower portions of canes and crowns.

Blackberry and Raspberry (continued)

Delayed Dormant (swollen buds) to Green Tip (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Fire ants	Extinguish Professional Fire Ant Bait (0.5 % methoprene)	1.0-1.5 lbs/ac 3-5 tbsp/ 1000 sq ft 3-5 tbsp/ mound	+++++	4 hrs	4 hrs	Extinguish Professional Fire Ant Bait (0.5% methoprene) is a slow-acting bait, do not expect visible control until 6 to 8 weeks after application. Extinguish Professional Fire Ant Bait is legal for use on 'crop land.' Caution, Extinguish baits with methoprene plus hydramethylnon are not labeled for use on crop land.
	malathion (Malathion 57EC)	1.5 pts	+	12 hrs	1 day	Malathion is a modestly effective material for mound drenches.

Shoots 6 inches long and before blooms open

Orange rust – Hosts affected: Navaho blackberry and black raspberry are very susceptible. Multiple spindly shoots that are light green in color, at first developing orange pustules on undersides of leaves only, indicate systemic infection of roots. Normal canes with orange spores indicate first-time infection. Disease control: Inspect planting thoroughly when new canes are 12-18 inches. Remove infected canes, recognized by weak growth and the presence of orange pustules. The varieties Cherokee, Cheyenne, Comanche, Choctaw (erect, thornless), Arapaho (erect, thornless), and Shawnee are considered resistant. The possibility of new races exists, as orange rust has been observed in all varieties. The varieties Darrow, Humble, and Navaho and black raspberries are susceptible. Wild blackberries should be eradicated within 0.25 mile of planting. Preventive fungicide applications are effective; however, once a plant shows symptoms, it has to be removed and destroyed.

Leaf and cane rust – Hosts affected: blackberry. Symptoms: floricanes uredinia with yellow spores erupting in fissures on canes and as leaf spots; primocane uredinia and aecia with yellow spores on leaves. Infected floricanes are stunted and delayed in development; can cause serious defoliation. Disease control: Remove floricanes immediately after harvest to limit primocane infection. Apply sprays at green tip and prior to bloom and resume after harvest until floricanes are removed. After floricanes removal, delay sprays until scouting indicates new infections of primocanes.

Powdery mildew – Hosts affected: black and red raspberries; rarely on blackberries. Light green blotches on upper leaf surface with white mycelium growth immediately beneath these blotches. In cases where infection is sparse, mottled appearance could be mistaken for virus symptoms. Disease control: This disease is usually not a problem but some western varieties are very susceptible if grown in the East. Powdery mildew fungicide treatments should begin at the first sign of disease and continue at 10-14 day intervals.

Clipper (strawberry weevil) – This is a small 3/16 inch (3 mm) long reddish brown weevil with bluish black wing covers. Clippers clip or sever stems just below the flower buds, leaving the clipped buds to dangle. Eggs are inserted into the dangling flower buds. Larvae develop within the buds, which typically fall to the ground. Apply insecticides when clippers and damage are present. Keep records to help refine scouting efforts and to improve the timing if preventative sprays are opted for in fields with a history of clipper injury.

Blackberry and Raspberry (continued)

Shoots 6 inches long and before blooms open (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Strawberry clipper (weevil)	malathion 57EC	1.5-3 pts	+++	12 hours	1 day	
	carbaryl (Sevin 80WSP)	1.25-2.5 lbs	+++	12 hrs	7 days	
	bifenthrin (Capture 2EC) (Brigade 10WSB)	3.2-6.4 fl ozs 8-16 ozs	++++	12 hrs	3 days	
Cane and leaf rust, orange rust, and yellow rust	myclobutanil (Nova 40W)	1.25-2.5 oz	+++++	24 hrs	1 day	Nova is registered for use on blackberry and raspberry. Nova is also active against powdery mildew. Begin applications as early as bud break, and continue applications on a 10-14 day schedule, depending on disease(s) and disease severity. Do not apply more than 10 oz/A per growing season.
	pyraclostrobin (Cabrio EG)	14 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Cabrio should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Cabrio or other strobilurins per acre per year.
	pyraclostrobin and boscalid (Pristine WG)	18.5-23 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Pristine per season.
Powdery mildew	sulfur-based products	See label	+++	24 hrs	not listed	Multiple formulations of sulfur are available. Kumulus is labeled for all brambles. Repeat at 10 day intervals as necessary.
	myclobutanil (Nova 40W)	1.25-2.5 oz	+++++	24 hrs	1 day	Nova is registered for use on blackberry and raspberry. Nova is also active against cane and leaf rust, orange rust and yellow rust. Begin applications as early as bud break, and continue applications on a 10-14 day schedule, depending on disease(s) and disease severity. Do not apply more than 10 oz/A per growing season.

Blackberry and Raspberry (continued)

Shoots 6 inches long and before blooms open (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Powdery mildew (Continued)	pyraclostrobin (Cabrio EG)	14 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Cabrio should be made before alternating with fungicides of different mode of action. No more than 4 applications of Cabrio /acre /season.
	azoxystrobin (Abound FL)	6.2-15.4 fl oz	+++++	4 hrs	0 days	No more than 2 sequential applications of Abound should be made before alternating with fungicides of different mode of action. No more than 6 applications of Abound/acre/season.
	pyroclastrobin and boscalid (Pristine WG)	18.5-23 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. No more than 4 applications of Pristine/season.
Anthracnose Cane blight, Spur blight, and Leaf spots	pyraclostrobin (Cabrio EG)	14 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Cabrio should be made before alternating with fungicides of different mode of action. No more than 4 applications of Cabrio /acre /season.
	azoxystrobin (Abound FL)	6.2-15.4 fl oz	+++++	4 hrs	0 days	No more than 2 sequential applications of Abound should be made before alternating with fungicides of different mode of action. No more than 6 applications of Abound/acre/season.
	pyroclastrobin and boscalid (Pristine WG)	18.5-23 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. No more than 4 applications of Pristine/season.
	Captan 80WDG	2.5 lb	++	72 hrs	3 days	Do not apply more than 12.5 lbs per acre per season.
	Captan 50W	4 lb	++	72 hrs	3 days	Do not apply more than 20 lbs per acre per season.
	copper-based products	See label	+	24 hrs	See label	Multiple copper-based materials are available, including copper hydroxide, copper sulfate and others. Apply prior to 3/4 inch shoot stage to avoid leaf burn. For raspberries only: Copper can cause phytotoxicity on black raspberry cultivars if used with Aliette. It is also an occasional problem on red raspberries.

Blackberry and Raspberry (continued)

Shoots 6 inches long and before blooms open (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Phytophthora root rot	mefenoxam (Ridomil Gold EC)	1/4 pt/1000 linear feet in a 3 ft band	++++	12 hrs	45 days	Ridomil is labeled only for raspberries and can be applied anytime during the spring.
	fosetyl-aluminum (Aliette WDG)	5 lbs	++++	12 hrs	60 days	The first foliar application of Aliette should be applied after bud break with at least 1-3 inches of new growth; repeat applications in 45-60 day intervals. Apply in the fall at least 30 days prior to leaf drop. Do not tank-mix Aliette with copper compounds. When applied prior to or after copper, the pH of Aliette WDG should be raised to 6 or above. Do not use adjuvants which enhance pesticide penetration with Aliette. For raspberries only: Copper can cause phytotoxicity on black raspberry cultivars if used with Aliette and occasionally on red raspberries.

Pre-Bloom (when flower buds show white)

Flower thrips – Flower thrips are small, cigar-shaped insects that are often quite abundant during bloom. When abundant, flower thrips can reduce fruit set and/or produce off-type seedy berries. Flower thrips may vector some plant viruses of brambles. Insecticides applied for flower thrips may be applied just before bloom or just after bloom.

Blackberry gall midge – This is a small fly. Females lay eggs in developing flower buds as bud scale separation begins to occur. Larval stage gall midges feed inside the developing buds, causing injury that is easily mistaken for cold injury. Fields with a history of gall midge should receive two pre-bloom insecticide applications.

Leafrollers and leaftiers – These are active, green caterpillars that feed on and either roll or tie together leaves. Treat if caterpillars and damage are seen.

Tarnished plant bugs – These are small bronze-colored bugs that resemble miniature stink bugs. Abundant plant bugs can abort blooms or cause berries to be seedy or misshapen. Treat if plant bugs are numerous, at least one plant bug per two flower clusters.

Insecticide applications for any of these pests should provide helpful control of other species if they are also present. Applications made as plants reach the white bud stage and then again just before blooms open should be effective.

Blackberry and Raspberry (continued)

Pre-Bloom (when flower buds show white; continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Strawberry clipper (weevil) Blackberry gall midge	bifenthrin (Capture 2EC) (Brigade 10WSB)	3.2-6.4 fl ozs 8-16 ozs	++++	12 hrs	3 days	Bifenthrin (Capture or Brigade) is an effective, long-lasting insecticide option. To protect pollinators, avoid applying bifenthrin within 5 days of anticipated first bloom.
Leafroller or Leaf-tier Tarnished plant bug	malathion 57EC	3 pts	+++	12 hrs	1 day	To protect pollinators, avoid malathion application within 3 days of anticipated first bloom.
Flower thrips	spinosad (SpinTor 2SC)	4 fl ozs	+++	4 hrs	1 day	After SpinTor dries it is of little risk to pollinators. If applied in the evening after bee foraging has stopped, SpinTor may be safely applied up to first bloom. Apply as-needed the day before bloom. SpinTor is a good choice for flower thrips and may be effective against gall midge and leafiers.
	pyrethrins & rotenone (Pyrellin EC)	1-2 pts	+	12 hrs	12 hrs	Pyrellin has a very short residual. It can be applied immediately pre-bloom during late afternoon, after bees stop foraging, with very modest risk to bees.
Anthracnose Cane blight, Spur blight, and Leaf spots	Same as Shoots Six Inches Long and Before Blooms open					
Cane and leaf rust, orange rust, and yellow rust	Same as Shoots Six Inches Long and Before Blooms open					

Blackberry and Raspberry (continued)

Early Bloom (5-10%)

Do Not Apply Insecticides During Bloom

Botrytis gray mold – Gray mold conidiophores and spores are gray in color and can be seen with hand lens on flowers and ripening fruit. Hosts affected: Black and Red Raspberry (highly susceptible), Blackberry (somewhat tolerant). Disease control: Blossom blight occurs in bloom and can spread rapidly on ripening fruit (gray mold). Apply fungicides at early bloom, full bloom and pre-harvest to protect flowers and ripening fruit. Pre-harvest sprays for gray mold control are generally not required in blackberry unless weather is cool and wet.

Rosette (double blossom) – Hosts affected: Blackberries. A proliferation of shoots (witches-broom) forms from a single bud, usually after normal bloom time. Pistils and ovaries of most flowers are replaced with spores. Some flowers in witches-brooms develop normally. Disease control: Start sprays when rosettes are blooming and primocanes begin to grow. Clip out witches-brooms as they develop and before they flower. (Estimated labor to do this, if done regularly each year on the Shawnee variety, is 40 hr/ac.) Remove and destroy floricanes promptly after harvest. If disease pressure is very high, cut all canes to 12-18 inches after harvest, fertilize heavily, and irrigate regularly to produce an adequate crop of canes. This procedure will reduce yields somewhat. The varieties Arapaho, Apache, and Navaho (erect cultivars), and Hull, Chester, and Loch Ness (semi-erect cultivars) are very tolerant of this disease. However, Arapaho and Apache seem to be very susceptible to freeze injury (W. Miller oral communication). Susceptible cultivars include Shawnee (100%), Choctaw (40%), Triple Crown (20%), and Black Satin (60%).

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Cane and leaf rust, orange rust, and yellow rust	Same as Shoots Six Inches Long and Before Blooms open					
Botrytis gray mold	iprodione (Rovral WDG, Rovral 4L)	1-2 lbs 1-2 pt	+++	24 hrs	1 day	Rovral is labeled for all brambles. Rovral WDG and 4L should be mixed with a protectant fungicide such as captan in a minimum of 100 gallons per acre. Do not make more than 4 applications per season. Do not make more than 2 consecutive applications before switching to a chemical with a different mode of action.
	fenhexamid (Elevate 50WDG)	1.5 lbs	+++++	12 hrs	12 hrs	Begin application at 10% bloom and continue through harvest. Avoid making more than two consecutive applications of Elevate before switching to a fungicide with another mode of action. Do not apply more than 6.0 lbs of material per acre per year.
	cyprodinil and fludioxonil (Switch 62.5WG)	11-14 oz	+++++	12 hrs	0 days	Begin application at early bloom and continue on a 7-10 day interval. Do not exceed 56 oz of product/acre/year. Make no more than two sequential applications before using a fungicide with another mode of action.
	pyraclostrobin and boscalid (Pristine WG)	18.5-23 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. Do not apply more than 4 applications of Pristine per acre/year.

Blackberry and Raspberry (continued)

Early Bloom (5-10%) (continued)

Do Not Apply Insecticides During Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Rosette (Double blossom)	bordeaux mixture 4-4-50 (see note below for directions)	See note	+++	24 hrs	1 day	Bordeaux mixture will cause leaf burn if applied on hot days or combined with insecticides.
	azoxystrobin (Abound FL)	6.2-15.4 fl oz	+++++	4 hrs	0 days	No more than 2 sequential applications of Abound should be made before alternating with fungicides that have a different mode of action. Do not apply more than six applications of Abound per acre per crop year.
	pyraclostrobin and boscalid (Pristine WG)	18.5-23 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Pristine per season.
	cyprodinil and fludioxonil (Switch 62.5WG)	11-14 oz	+++++	12 hrs	0 days	Begin application at early bloom and continue on a 7-10 day interval. Do not exceed 56 oz of product/acre/year. Make no more than two sequential applications before using a fungicide with another mode of action.
Anthracnose Cane blight, Spur blight, and Leaf spots	pyraclostrobin (Cabrio EG)	14 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Cabrio should be made before alternating with fungicides of different mode of action. No more than 4 applications of Cabrio /acre /season.
	azoxystrobin (Abound FL)	6.2-15.4 fl oz	+++++	4 hrs	0 days	No more than 2 sequential applications of Abound should be made before alternating with fungicides of different mode of action. No more than 6 applications of Abound/acre/season.
	pyroclastrobin and boscalid (Pristine WG)	18.5-23 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. No more than 4 applications of Pristine/season.
	Captan 80WDG	2.5 lb	++	72 hrs	3 days	Do not apply more than 12.5 lbs per acre per season.
	Captan 50W	4 lb	++	72 hrs	3 days	Do not apply more than 20 lbs per acre per season.
Powdery mildew	Same as Shoot 6 inches long stage					

Blackberry and Raspberry (continued)

Early Bloom (5-10%) (continued)

Do Not Apply Insecticides During Bloom

Bordeaux recipe – 1. Fill spray tank to one-half the desired volume of water. 2. Turn on the agitator. 3. Dissolve powdered bluestone (copper sulfate) in the spray tank at a rate of 4 lbs bluestone/ 50 gals water. 4. Make a “milk of lime” suspension by dissolving 4 lbs of hydrated lime (calcium hydroxide) in 5 gallons of water in a container, for a rate of 4 lbs hydrated lime/ 50 gals water. 5. Slowly add the “milk of lime” suspension into the spray tank. 6. Fill the spray tank to the desired volume of water. 7. Maintain constant agitation and apply immediately. Do not mix with Benlate or Sevin. Bordeaux mixture will cause severe leaf burn if applied on very hot days or if combined with insecticides. A slight phytotoxicity will have relatively minor impact.

Full Bloom

Do Not Apply Insecticides During Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Rosette (Double blossom)	azoxystrobin (Abound FL)	6.2-15.4 fl oz	+++++	4 hrs	0 days	No more than 2 sequential applications of Abound should be made before alternating with fungicides that have a different mode of action. Do not apply more than six applications of Abound per acre per crop year.
	pyraclostrobin and boscalid (Pristine WG)	18.5-23 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Pristine per season.
	cyprodinil and fludioxonil (Switch 62.5WG)	11-14 oz	+++++	12 hrs	0 days	Begin application at early bloom and continue on a 7-10 day interval. Do not exceed 56 oz of product/acre/year. Make no more than two sequential applications before using a fungicide with another mode of action.
Botrytis gray mold	Same as Early Bloom (5-10%)					
Anthracnose Cane blight, Spur blight, and Leaf spots	Same as Early Bloom (5-10%)					
Cane and leaf rust, orange rust, and yellow rust	Same as Shoot 6 inches long stage					

Blackberry and Raspberry (continued)

Full Bloom (continued)

Do Not Apply Insecticides During Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Powdery mildew	myclobutanil (Nova 40W)	1.25-2.5 oz	+++++	24 hrs	1 day	Nova is registered for use on blackberry and raspberry. Nova is also active against cane and leaf rust, orange rust and yellow rust. Begin applications as early as bud break, and continue applications on a 10-14 day schedule, depending on disease(s) and disease severity. Do not apply more than 10 oz/A per growing season.
	pyraclostrobin (Cabrio EG)	14 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Cabrio should be made before alternating with fungicides of different mode of action. No more than 4 applications of Cabrio /acre /season.
	azoxystrobin (Abound FL)	6.2-15.4 fl oz	+++++	4 hrs	0 days	No more than 2 sequential applications of Abound should be made before alternating with fungicides of different mode of action. No more than 6 applications of Abound/acre/season.
	pyroclastrobin and boscalid (Pristine WG)	18.5-23 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. No more than 4 applications of Pristine/season.

Petal Fall

Tarnished plant bugs and stink bugs – Tarnished plant bugs are small, 1/4 inch long, insects that resemble miniature stink bugs. They are mottled yellow brown in color. Stink bugs of several species are occasional pests of brambles. Stink bugs are medium to large, shield-shaped insects. Both plant bugs and stink bugs have piercing and sucking mouthparts. They feed on the flower buds and developing fruits of many plant species. If abundant, plant bugs or stink bugs can cause poor fruit set or misshapen, deformed or excessively seedy berries.

Red necked cane borer – The red necked cane borer is a 1/4 inch long beetle with a black head and wing covers, and a reddish thorax. Adults are typically present in brambles from May until June. Larval stage red necked cane borers tunnel within canes in a spiral fashion, producing 3 inch long swollen, galled areas. Galled canes should be rogued out and destroyed whenever they are found. Insecticide applications are only effective on the adults. In blocks with a history of red necked cane borer injury, scout for adults in May. Application of insecticides at petal fall and again in 10 to 14 days typically provides good control of red necked cane borer. Keep records to help refine pest management efforts in subsequent years.

Blackberry and Raspberry (continued)

Petal Fall (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Flower thrips Plant bugs Stink bugs	esfenvalerate (Asana XL)	4.8-9.6 fl ozs	+++	12 hrs	7 days	
Strawberry clipper Red necked cane borer	bifenthrin (Capture 2EC, Brigade 10WSB)	3.2-6.4 fl ozs 8-16 ozs	++++	12 hrs	3 days	
	malathion 57EC	3 pt	+++	12 hrs	1 day	
Botrytis gray mold	Same as Early Bloom (5-10%)					
Anthracnose Cane blight, Spur blight, and Leaf spots	Same as Early Bloom (5-10%)					
Cane and leaf rust, orange rust, and yellow rust	Same as Shoot 6 inches long stage					
Powdery mildew	Same as Full Bloom stage					
Rosette (Double blossom)	Same as Full Bloom stage					

Cover Sprays

Blackberry psyllid – This is a tiny, cicada-like insect. Psyllid injury is similar to that caused by heavy aphid infestations. New growth can be severely malformed and misshapen. Blackberry psyllid overwinters on conifers such as pine, red cedar or white cedar. Avoidance is an excellent management tool. Blackberries one mile or more from conifers seldom have psyllid infestations. If possible, avoid planting brambles within 250 yards of conifers. Timing varies with geography and site, but psyllids often move from conifers to brambles from early- to mid-April. Foliar distortion is seen within 7 to 10 days. Spray when psyllids and injury are first observed, and note the date and stage of development in your field to begin developing a personalized IPM calendar for your bramble production.

Japanese beetles – Japanese beetles are large beetles with metallic green wing covers, coppery undersides and a series of white tufts along the outside of the abdomen. Japanese beetles are gregarious foliage and fruit feeders. They can be overwhelmingly abundant following drought-breaking rains, which promote large, synchronous emergences of adults. Defoliation is of modest concern until perhaps 10% of the leaf area has been consumed. However, the difficulty of controlling large numbers of beetles favors controlling Japanese beetles before they become too abundant. Multiple insecticide applications, applied at 3 to 7 day intervals, may be required when Japanese beetles are abundant.

Blackberry and Raspberry (continued)

Cover Sprays (continued)

Spider mites – Spider mites are occasional pests of brambles. They are favored by hot, dry weather. Spider mites are small, spider-like relatives of insects. Spider mites feed, normally on the underside of leaves, by puncturing leaves with needle-like stylets; this wounding process releases cellular fluids which the mite consumes. Feeding produces clear or whitish stippling. If mites are very abundant, leaves may take on a bronze to silvered appearance. Spider mites will often spin webbing on the underside of leaves when they are very abundant. Mite injury is cumulative; mites can be quite injurious if untreated.

Fire ants – These can be nuisance pests in vineyards. **Optimal fire ant control programs for fruit make use of spring and fall broadcast bait applications.** Twice-a-year bait applications may be best in year-one of a program to thoroughly suppress the ant population. In subsequent years, a single bait application 8 to 10 weeks before harvest may provide adequate ant control. Ant baits work best when soil is moist, but not wet. Active ant foraging is essential. Ideally, temperatures should be warm and sunny. Avoid application of ant baits when conditions are expected to be cold, overcast, rainy or very hot. **Treatment of individual mounds is often a necessary complement to broadcast bait use if the goal is to obtain even short-term elimination of fire ants.** Extinguish Professional Fire Ant Bait [Zoecon, Wellmark International] is a very effective, but slow acting option (8-10 weeks for colony elimination). Mound drenches with malathion (REI 12 hrs/PHI 24 hrs), or foliar application of malathion to get ants off of the plants immediately pre-harvest, should be modestly effective. Individual mound treatments with curative materials that promptly kill ants may be more cost-effective than using baits. Insecticide mound drenches are most effective when 1 to 2 gallons of dilute material are slowly applied per mound. Bait treatment of mounds should place bait in a 3 to 4 feet circle around each mound. Do not disturb mounds or place bait directly on top of mounds.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Botrytis gray mold	Same as Early Bloom (5-10%)					
Anthracnose Cane blight, Spur blight, and Leaf spots	Same as Early Bloom (5-10%)					
Cane and leaf rust, orange rust, and yellow rust	Same as Shoot 6 inches long stage					
Powdery mildew	Same as Full Bloom stage					
Rosette (Double blossom)	Same as Full Bloom stage					

Blackberry and Raspberry (continued)

Cover Sprays (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Botrytis gray mold	Same as Early Bloom (5-10%)					
Anthraxnose Cane blight, Spur blight, and Leaf spots	Same as Early Bloom (5-10%)					
Cane and leaf rust, orange rust, and yellow rust	Same as Shoot 6 inches long stage					
Powdery mildew	Same as Full Bloom stage					
Rosette (Double blossom)	Same as Full Bloom stage					
Strawberry clipper Red necked cane borer Blackberry psyllid Japanese beetles Stink bugs	malathion 57EC	1.5-3 pts	+++	12 hrs	1 day	
	carbaryl (Sevin 80WSP)	1.25-2.5 lbs	+++	12 hrs	7 days	
Stink bugs Mites	bifenthrin (Capture 2EC Brigade 10WSB)	3.2-6.4 fl ozs 8-16 ozs	++++	12 hrs	3 days	Bifenthrin is a good stink bug material. It is also a reliable curative miticide. However, bifenthrin is a pyrethroid, use with caution, as mite numbers are inclined to rebound after use of any pyrethroid.
Mites	hexythiazox (Savey 50DF)	4-6 ozs	+++++	12 hrs	3 days	Savey is best used on low mite populations that are building or as a preventative. Savey is a preventative miticide that primarily controls eggs, it has a long residual, but it is slow acting. Allow 10 days to see a clear reduction in mite numbers.
	light, summer-weight horticultural oils (Saf-T-Cide, Ultra Fine Spray Oil)	1.5-2 % by volume	++	4 hrs	0 days	Summer oils are effective in moderating low mite populations pre-harvest. Use on a trial basis only until certain oil will not result in fruit finish problems. DO NOT use oils within 14 days of using any sulfur containing material.

Blackberry and Raspberry (continued)

Pre-Harvest (14-days before anticipated first harvest)

SAP BEETLES, sometimes called picnic beetles, are strongly attracted to ripening fruit. Sanitation, in the form of conscientiously picking all ripe fruit on a daily basis, is the most important management option for controlling sap beetles. Bait buckets filled with overripe fruit may be used on the perimeter of fields to attract sap beetles and other ripe fruit pests. If several days of rain preclude picking, it may be necessary to send laborers into fields in advance of pick-your-own customers to remove overripe fruit. In these salvage situations; an application of pyrethrum-containing products may also be required.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Japanese beetles Sap beetles	carbaryl (Sevin 80WSP)	1.25-2.5 lbs	++++	12 hrs	7 days	
Stink bugs	bifenthrin (Capture 2EC Brigade 10WSB)	3.2-6.4 fl ozs 8-16 ozs	++++	12 hrs	3 days	
	malathion 57EC	2-4 pt	+++	12 hrs	1 day	
	pyrethrins and rotenone (Pyrellin EC)	1-2 pts	++	12 hrs	12 hrs	
Sap beetles	azadiractin (Aza-Direct)	5 fl ozs	++	4 hrs	4 hrs	
	Bait Buckets		+++			Sap beetles: Bait buckets, and prompt removal of overripe fruit, should be used to provide cultural suppression to augment as-needed insecticide. Place overripe fruit in bucket around the perimeter of fields to attract sap beetles.
Mites	hexythiazox (Savey 50DF)	4 – 6 ozs	+++++	12 hrs	3 days	Savey is a poor option by late season, as it most useful as an early-season preventative material, or to moderate mite populations that are building. It is primarily an ovicide; it has a long residual, but it is slow acting. Allow 10 days to see a clear reduction in mite numbers.
	bifenthrin (Capture 2EC Brigade 10WSB)	3.2-6.4 fl ozs 8-16 ozs	++++	12 hrs	3 days	

Blackberry and Raspberry (continued)

Pre-Harvest (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Mites (continued)	Light, Summer-Weight Horticultural Oils (Saf-T-Cide, Ultra Fine Spray Oil)	1.5-2 % by volume	++	4 hrs	0 days	Summer oils may be of some use in moderating low mite populations pre-harvest. Use on a trial basis only until certain oil will not result in fruit finish problems. DO NOT use oils within 14 days of any sulfur containing material.
Botrytis gray mold	Same as Early Bloom (5-10%)					
Anthraxnose Cane blight, Spur blight, and Leaf spots	Same as Early Bloom (5-10%)					
Cane and leaf rust, orange rust, and yellow rust	Same as Shoot 6 inches long stage					
Powdery mildew	Same as Full Bloom stage					
Rosette (Double blossom)	Same as Full Bloom stage					
Harvest						
Botrytis gray mold	Same as Early Bloom (5-10%)					
Anthraxnose Cane blight, Spur blight, and Leaf spots	Same as Early Bloom (5-10%)					
Cane and leaf rust, orange rust, and yellow rust	Same as Shoot 6 inches long stage					
Powdery mildew	Same as Full Bloom stage					
Rosette (Double blossom)	Same as Full Bloom stage					

Blackberry and Raspberry (continued)

Harvest (continued)

Phytophthora root rot	Same as Shoots 6 inches long stage					
-----------------------	---	--	--	--	--	--

Cane blight – Cane blight can be a major disease of blackberry in the Southeast, resulting in severe losses – sometimes resulting in the complete destruction of fruiting canes in any given year. It is generally not reported in other states as a major disease of blackberries, except when winter injury occurs on thornless blackberries, and most of the reports are associated with raspberry. However, wet, humid conditions observed in Georgia and other southeastern states allow for significant losses following pruning or other injuries to the primocane. Avoid wounding the primocanes whenever possible. However, pruning is necessary for blackberry production, so wounding will occur through pruning operations. Pruning wounds are the primary site of infection, especially following prolonged rains, such as those observed in tropical storms and hurricanes. Rainfall or overhead irrigation will disperse fungal spores to fresh wound sites and create favorable conditions for infection. Always check the weather forecast before pruning operations. If at all possible, prune when at least four days of dry weather is expected. During the summer, “pinch off” or “tip” tender primocanes when they reach 3-4 feet in height, as opposed to cutting. Practices which promote quick drying of the canopy will help to decrease infection. A weed-free strip under the canopy will also aid drying and air movement. Strobilurin fungicides (Pristine, Cabrio, Abound) or Benlate (if still available, can be used till 12/31/07) + Captan should be applied after pruning each day to provide a protective barrier on the wound site until healing can occur. See <http://www.smallfruits.org/bramble/pestinformation/caneblightfactsheetii.pdf> for additional information.

Orange felt (orange cane blotch) – Orange felt is especially prevalent on blackberries grown in very hot, wet, and humid environments, such as those encountered in much of the Coastal Plain areas of the Southeast. Where colony formation (i.e. the degree of coverage of the cane) is limited, it has been stated that this alga does not limit blackberry production. However, although research trials have not been conducted to determine the effects of this algal species in Georgia, we are currently recommending that producers utilize control methods. Where ideal environmental conditions occur, this alga may girdle canes or exacerbate other cane diseases, causing subsequent decline and death. Practices which promote quick drying of the canopy will help to decrease infection. A weed-free strip under the canopy will also aid in drying and air movement. Where producers have bedded and installed black plastic and drip-tape irrigation systems, orange felt has been reduced substantially. Avoid stressing plants, making sure that all nutrient and water requirements are met. Soil and tissue samples allow for accurate fertilization and pH assessments. Avoid planting in poorly drained sites. Copper sprays should also help to prevent spread. Many copper products are registered for control of a multitude of blackberry diseases, using relatively high rates for late dormant and fall applications and lower rates for times in which succulent tissue is present (read all labels for specific directions). See <http://www.smallfruits.org/bramble/pestinformation/orangefelt.pdf> for additional information.

Blackberry and Raspberry (continued)

After-Harvest (after fruit has been harvested)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Leaf spots	(Captan 80WDG)	2.5 lb	++	72 hrs	3 days	Do not apply more than 12.5 lbs of Captan 80WDG per acre per season.
	(Captan 50W)	4 lb	++	72 hrs	3 days	
	pyraclostrobin (Cabrio EG)	14 oz	+++	24 hrs	0 days	No more than 2 sequential applications of Cabrio should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Cabrio or other strobilurins per acre per crop year.
	azoxystrobin (Abound FL)	6.2-15.4 fl oz	+++	4 hrs	0 days	No more than 2 sequential applications of Abound should be made before alternating with fungicides that have a different mode of action. Do not apply more than six applications of Abound per acre per crop year.
	pyroclastrobin and boscalid (Pristine WG)	18.5-23 oz	+++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Pristine per season.
Orange cane blotch	copper-based products	See label	+	24 hrs	See label	Multiple copper-based materials are available, including copper hydroxide, copper sulfate and others. Apply prior to 3/4 inch shoot stage to avoid leaf burn. For raspberries only: Copper can cause phytotoxicity on black raspberry cultivars if used with Aliette. It is also an occasional problem on red raspberries.
Cane blight						See information box above.
Fire ants	Extinguish Professional Fire Ant Bait (0.5 % methoprene)	1.0-1.5 lbs/ac 3-5 tbsp/ 1000 sq ft 3-5 tbsp/ mound	++++	4 hrs	4 hrs	Extinguish Professional Fire Ant Bait (0.5% methoprene) is a slow-acting bait, do not expect visible control until 6 to 8 weeks after application. Extinguish Professional Fire Ant Bait is legal for use on 'crop land.' Caution, Extinguish baits with methoprene plus hydramethylnon are not labeled for use on crop land.
	malathion 57EC	1.5 pts	+	12 hrs	1 day	Malathion is a modestly effective material for mound drenches.

Blackberry and Raspberry (continued)

After-Harvest (after fruit has been harvested)

Raspberry crown borer	bifenthrin (Capture 2EC Brigade 10WSB)	3.2-6.4 fl ozs 8-16 ozs	++++	12 hrs	3 days	Rogue infested canes after harvest. Insecticides for crown borer may be applied in July and August, targeting the egg-laying adults, eggs and the first larval stage. Thoroughly wet foliage when employing a late-summer or early-fall application.
-----------------------	---	----------------------------	------	--------	--------	--

Seasonal 'at a glance' fungicide spray schedule options for brambles

Developmental Stage	Delayed Dormant (swollen buds) to Green Tip	Shoots 6" long till Pre-Bloom (when flower buds show white)	Early bloom (5-10%)	Full Bloom ^a	Petal Fall	Cover Sprays	Pre-Harvest	Harvest	After Harvest
Disease Controlled (Fungicides)	Anthracnose, Spur Blight, Cane Blight (Lime Sulfur or Copper)	Anthracnose, Cane Blight, Spur Blight, and Leaf Spots (Copper, Cabrio, Abound, Pristine, and Captan) Rusts (Nova, Cabrio, Pristine) Powdery Mildew (Sulfur, Nova, Cabrio, Abound, Pristine) Phytophthora Root Rot (Ridomil, Alette)	Botrytis (Rovral, Elevate, Switch, Pristine) Rosette (Switch, Abound, Pristine) Powdery Mildew (Nova, Cabrio, Abound, Pristine) Rusts (Nova, Cabrio, Pristine) Anthracnose, Cane Blight, Spur Blight, and Leaf Spots (Cabrio, Abound, Pristine, and Captan)	Botrytis (Rovral, Elevate, Switch, Pristine) Rosette (Switch, Abound, Pristine) Powdery Mildew (Nova, Cabrio, Abound, Pristine) Rusts (Nova, Cabrio, Pristine) Anthracnose, Cane Blight, Spur Blight, and Leaf Spots (Cabrio, Abound, Pristine, and Captan)	Botrytis (Rovral, Elevate, Switch, Pristine) Rosette (Switch, Abound, Pristine) Powdery Mildew (Nova, Cabrio, Abound, Pristine) Rusts (Nova, Cabrio, Pristine) Anthracnose, Cane Blight, Spur Blight, and Leaf Spots (Cabrio, Abound, Pristine, and Captan)	Botrytis (Rovral, Elevate, Switch, Pristine) Rosette (Switch, Abound, Pristine) Powdery Mildew (Nova, Cabrio, Abound, Pristine) Rusts (Nova, Cabrio, Pristine) Anthracnose, Cane Blight, Spur Blight, and Leaf Spots (Cabrio, Abound, Pristine, and Captan)	Botrytis (Rovral, Elevate, Switch, Pristine) Rosette (Switch, Abound, Pristine) Powdery Mildew (Nova, Cabrio, Abound, Pristine) Rusts (Nova, Cabrio, Pristine) Anthracnose, Cane Blight, Spur Blight, and Leaf Spots (Cabrio, Abound, Pristine, and Captan)	Botrytis (Rovral, Elevate, Switch, Pristine) Rosette (Switch, Abound, Pristine) Powdery Mildew (Nova, Cabrio, Abound, Pristine) Rusts (Nova, Cabrio, Pristine) Anthracnose, Cane Blight, Spur Blight, and Leaf Spots (Cabrio, Abound, Pristine, and Captan)	Phytophthora Root Rot (Ridomil) Cane Blight (see notes) Orange Cane Blotch (Copper; see notes and labels) Powdery Mildew (Nova, Cabrio, Abound, Pristine) Rusts (Nova, Cabrio, Pristine) Leaf Spots (Captan)

^aBramble bloom periods are protracted, so bloom and cover spray can be difficult to define clearly. Do not exceed label rates or spray intervals, but make sure that the pathogens indicated above are addressed with a thorough fungicide program as defined by the variety.

Fungicide classes with high risk of resistance development (generally single sites of action)	
Anilopyrimidine	Switch (cyprodinil; one component of a two-part mixture)
Carboximide	Pristine (boscalid; one component of a two-part mixture)
Demethylation Inhibitors (DMIs) or Sterol Inhibitors	Nova (myclobutanil)
Dicarboximides	Rovral (iprodione)
Hydroxyanilides	Elevate (fenhexamid)
Phenylamides	Ridomil Gold (mefanoxam)
PhenylPyrroles	Switch (fludioxonil; one component of a two-part mixture)
Strobilurins or QoI (Quinine outside Inhibitors)	Abound (azoxystrobin) Pristine (pyroclostrobin; one component of a two-part mixture) Cabrio (pyroclostrobin)
Fungicide classes with low risk of resistance development (generally multiple sites of action)	
Several Classes	Captan (Captan or Captec) Coppers (numerous formulations) Sulfurs (numerous formulations)

Seasonal ‘at a glance’ insecticide spray schedule options for brambles

Developmental Stage	Delayed Dormant (swollen buds) to Green Tip	Shoots 6” long	Pre-Bloom	Petal Fall	Cover Sprays	Pre-Harvest	After Harvest
Insects Controlled (Insecticides & Miticides)	Raspberry Crown Borer (Asana, Malathion) Fire Ants (Extinguish Professional Fire Ant Bait, Malathion)	Strawberry Clipper (Capture or Brigade, Sevin, Malathion)	Strawberry Clipper (Capture or Brigade, Sevin, Malathion) Flower Thrips (SpinTor, Pyrellin)	Flower Thrips, Tarnished Plant Bug, Stink Bugs (Asana) Strawberry Clipper, Red Necked Cane Borer (Capture, Brigade, Malathion)	Strawberry Clipper, Red Necked Cane Borer, Blackberry Psyllid, Japanese Beetle, Stink bugs (Malathion, Sevin) Stink Bugs, Spider Mites (Capture or Brigade) Mites (Savey, Light Summer Oils)	Japanese Beetle, Sap Beetle, Stink Bug (Sevin, Brigade, Malathion, Pyrellin, Aza-Direct, Bait Buckets) Mites (Savey, Capture, Brigade, Light Summer Oils)	Red necked cane borer, Raspberry crown borer (Capture or Brigade) Fire ants (Extinguish Professional Fire Ant Bait)

Insect and mite management – The pest management options recommended in this guide should provide a reliable template for planning and carrying out IPM tactics. It is by no means definitive and will certainly need to be modified and fine tuned to fit pest patterns and pressures on your farm. Insect and mite pests of brambles vary considerably in their significance from year to year, from one block to the next, and certainly within the southeastern states. As experience dictates, gradually modify your farm IPM plan, determining which sprays are essential and which should be reserved for as-needed use. Cultural practices such as roguing out borer-infested canes, destroying wild brambles near cultivated fields or planting brambles away from conifers will lower pest pressures. Insecticides and miticides are toxins. They should be used with judicious caution, with strict adherence to pesticide label cautions. Develop a bramble insect and mite plan of action well before the season begins. Study the seasonality of pest pressures and make plans for monitoring to assure seeing pests before they become damaging. Study the strengths and weaknesses of each insecticide or miticide. In general, the organophosphate malathion is a good broad spectrum insecticide, which should seldom promote flare-ups of secondary pests such as mites. For the remainder of 2005 azinphos methyl (Guthion or Sniper) may be used. It is extremely toxic to humans which results in its lengthy 7-day REI and 14-day PHI. Azinphos methyl is a fine insecticide but should be used with extreme caution. Never use azinphos methyl in any sort of hand or backpack sprayer. The carbamate carbaryl (Sevin) is also a reliable broad spectrum insecticide, and it is a safe material to use. Carbaryl use sometimes encourages mite problems. The pyrethroid insecticides esfenvalerate (Asana) and bifenthrin (Capture or Brigade) are also broad spectrum materials. Pyrethroids are quite prone to developing resistance problems. Capture or Brigade (bifenthrin) is the best all-around insecticide/curative miticide for use in brambles, avoid overusing these materials by relying on malathion or Sevin when possible. Pyrethroids are especially good against caterpillars, and they are generally good against thrips, plant bugs and stink bugs. Bifenthrin, Capture or Brigade, is a reliable curative miticide, but rebounding mite numbers are commonly seen after any pyrethroid is used.

Weed Management

Blackberry and Raspberry

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
PREPLANT/ SITE PREPARATION	Glyphosate Roundup WeatherMax 5.5 SL or Various Generic Formulations 4 SL	1.4 to 2.8 pt 1 to 2 qt	Apply 30 days prior to planting	12	Use to kill strips through vineyard prior to planting. Generic formulations may require the addition of a surfactant. See label for details on controlling specific perennial weeds.
	PREEMERGENCE Annual grasses and small seeded broadleaf weeds	Napropamide Devrinol 50 WDG	8 lb	Newly planted (once soil has settled after transplanting) and established plantings.	12
Oryzalin Surflan 4 AS or FarmSaver Oryzalin		2 to 4 qt	Newly planted (once soil has settled after transplanting) and established plantings.	12	Surflan or FarmSaver Oryzalin may be tank mixed with paraquat for postemergence weed control. In established plantings tank mix with simazine for broad spectrum residual weed control.
Norflurazon Solicam 80 DF		1.25 to 5 lb	Plantings established at least 1 year or more.	12	Apply to dormant blackberry and raspberry. Tank mix with paraquat for control of emerged weeds. Residual control is expanded when Solicam is tank mixed with simazine. Do not apply within 60 days of harvest.
PREEMERGENCE Broadleaf weeds	Isoxaben Gallery	0.66 to 1.33 lb	Newly planted or non-bearing plantings.	12	Apply in at least 10 gallons per acre. Tank mix with Surflan for broad spectrum residual control.
PREEMERGENCE Annual weeds and some perennial weeds	Dichlobenil Casoron 4G	100 to 150 lb	Plantings established at least one year.	12	Apply in January or February for best results. Warm temperatures increase volatilization therefore overhead irrigation may be use for activation when applied in early spring.

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
PREEMERGENCE Broadleaf weeds and some annual grasses	Simazine Princep 4 L or Princep Cal 90 or various generic formulations	2 to 4 qt 2.2 to 4.4 lb	Newly planted (use half rate and apply once soil has settled after transplanting) and established plantings.	12	Tank mix with paraquat for postemergence weed control. The addition of oryzalin (Surflan) or norflurazon (Solicam) with simazine will extend residual grass control several weeks. Rate is soil texture dependent.
	Terbacil Sinbar 80 WP	1 to 2 lb	Plantings established 1 year or more.	12	Apply as directed spray in early fall or spring before fruit set. Do not contact foliage. Do not apply with in 70 days of harvest. Do not use loamy sand or sandy soils. Do not use on soils having less than 1 % organic matter.
POSTEMERGENCE Non-selective control	Glyphosate Roundup WeatherMax 5.5 SL or Various Generic Formulations 4 SL	1.4 to 2.8 pt 1 to 2 qt	Plantings established 1 year or more.	12	EXTREME care must be taken to avoid contact with the crop to prevent death or injury. Brambles are least susceptible to injury when dormant or in early spring. Applications during bloom and through fall are likely to be more injurious if poorly done. Apply as a directed, shielded spray to the base of crop. Wiper applications may be used as well. Do not apply within 14 days of harvest. Some generic formulations require additional surfactant. Roundup WeatherMax is not registered on raspberries.
POSTEMERGENCE Non-selective control (Continued)	Paraquat Gramoxone Max 3 SL	1.7 to 2.7 pt	Newly planted (shielded) and established plantings	12	Do not allow herbicide to contact desirable foliage or green canes. Young plants must be shielded. The addition of a non-ionic surfactant at 0.25 % v/v (1qt per 100 gal. of spray solution) is necessary for adequate control. Tank mix with preemergence herbicides for residual control.
POSTEMERGENCE Broadleaf weeds and yellow nutsedge	Bentazon Basagran	1.5 to 2 pt	Newly planted or non-bearing plantings	48	Apply as a directed spray in a minimum spray volume of 20 gal./A. Add 2 pt of crop oil concentrate per acre for optimum results. Timely, sequential applications will control yellow nutsedge. Refer to label for details.

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
POSTEMERGENCE Annual and perennial grasses	Clethodim Select 2EC or Arrow 2EC	6 to 8 oz	Newly planted or non-bearing plantings	12	Low rates are for annual grass weeds. High rates and sequential applications are for perennial grasses (bermudagrass or johnsongrass). The addition of a non-ionic surfactant at 0.25 % v/v (1 qt/100 gal. of spray solution) is required.
POSTEMERGENCE Annual and perennial grasses	Fluazifop Fusilade DX	12 to 24 oz	Newly planted and non-bearing plantings	12	Sequential applications will be necessary for perennial grass control. The addition of a non-ionic surfactant (1 qt/100 gal of water) or crop oil concentrate (1 gal./100 gal. of water) is necessary.
	Sethoxydim Poast	1 to 2.5 pt	Newly planted and established plantings	12	Sequential applications will be necessary for perennial grass control. The addition of a non-ionic surfactant (1 qt/100 gal of water) or crop oil concentrate (1 gal/100 gal. of water) is necessary. Do not apply within 50 days of harvest. Total use can not exceed 5 pt/A per

Suggested Herbicide Programs (Blackberry and Raspberry)

Crop Age	Fall	Winter	Spring	Summer
Newly Planted	Glyphosate (preplant)		Oryzalin (Once soil settles after transplanting)	Oryzalin + Paraquat (May or June); Fusilade, or Poast, or Select (as needed). Shallow cultivation may be used as well.
	Glyphosate (preplant)		Simazine (half rate) + Oryzalin	Paraquat (multiple applications as needed); Basagran, or Fusilade, or Poast, or Select (as needed)
	Glyphosate (preplant)		Devrinol (Once soil settles after transplanting)	Paraquat (multiple applications as needed); Basagran, or Fusilade, Poast, or Select (as needed)
	Glyphosate (preplant)		Gallery + Oryzalin	Paraquat (multiple applications as needed); Basagran, or Fusilade, Poast, or Select (as needed)
Blackberry and Raspberry Established 1 or more years	Simazine + Paraquat		Sinbar	Paraquat (multiple applications as needed); Basagran, or Fusilade, Poast, or Select (as needed)
		Simazine + Solicam + Paraquat		Paraquat (multiple applications as needed); Basagran, or Fusilade, Poast, or Select (as needed)
	Sinbar + Paraquat		Simazine + Surflan	Paraquat (multiple applications as needed); Basagran, or Fusilade, Poast, or Select (as needed)
Blackberry and Raspberry Established 1 or more years (continued)	Paraquat	Casoron		Paraquat (multiple applications as needed); Basagran, or Fusilade, Poast, or Select (as needed)

Blackberry Dormex Use to Enhance Fruit Ripening and Yield of Certain Cultivars (Georgia Label)

For Use Only in the State of Georgia

Response:	If properly used, Dormex can stimulate more rapid and uniform bud break of marginally high chilling blackberry cultivars such as 'Apache' and 'Navaho' in South Georgia. Other high chilling cultivars have not been tested and should only be treated on a trial basis. A yield increase was also observed in 2002-2003 after a high chilling winter, probably due to improved bud break in the low part of the canopy.
Material:	Dormex-50% hydrogen cyanamide
Timing: Note:	Timing of Dormex applications is extremely important in order to achieve the desired response and avoid plant injury. Apply during the dormant season after significant winter chilling has been received, but before obvious bud swell. Application at least 35 days before normal bud break is recommended. Generally late January has been a good application period, but plants must be examined for their stage of development. If obvious bud swell has occurred, chemical injury to the buds is highly possible.
Rate of Material:	Apply 3% Dormex with 0.5% non-ionic surfactant in 50 gallons of water per acre. This rate is 1.5 gallons of Dormex plus one quart of non-ionic surfactant in 50 gallons of water.
Remarks:	<ol style="list-style-type: none">1. Dormex is a toxic material and registered for application only with closed cab tractors. Before use read all Dormex label sections carefully.2. Do not consume alcoholic beverages prior to, during, and following (24 hours) handling the product. Do not enter or allow entry into treated areas during the restricted entry interval (REI) of 72 hours.3. Dormex is highly corrosive to equipment. Clean up thoroughly after application.4. Avoid drift. Dormex may be toxic to green plants such as winter vegetable crops, shrubs, pets, cattle, etc. Use a spray pressure of 50 psi to reduce drift.5. Apply during dry weather, when temperatures are moderate (neither freezing nor hot). Make application at least 24 hours before expected rainfall.6. Dormex may advance bud break and flowering by several days, slightly increasing the risk of freeze damage.7. Moderate chilling cultivars such as 'Kiowa' and 'Arapaho' will probably need Dormex only in very low chilling winters (less than 500 hours).

Information Developed by Gerard Krewer and James Jacobs (University of Georgia)

