2024

Southeast Regional Caneberry

INTEGRATED MANAGEMENT GUIDE

2024 Southeast Regional Caneberry Integrated Management Guide

A product of the Southern Region Small Fruit Consortium

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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. Registrations also vary between states and are subject to change at any time, please check with your state department of agriculture or regulatory agency concerning current registration status within your state. 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.

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Pesticide Stewardship and Safety

PESTICIDE EMERGENCIES

1-800-222-1222

This number automatically connects you with a local Poison Control Center from anywhere in the United States.

Symptoms of Pesticide Exposure

- **Tightening of the chest, mental confusion, blurred vision, rapid pulse, intense thirst, vomiting, convulsions, and unconsciousness are always serious symptoms! Dial 911!**
- **Pesticides with 'DANGER' or 'DANGER/POISON' on the product label can cause severe injuries or death very quickly, even with small exposures. Take immediate action!**
  Other symptoms of pesticide poisoning: headache, fatigue, weakness, restlessness, nervousness, profuse sweating, tearing and drooling, nausea, diarrhea, or irritation of the skin/ eyes/nose/throat. Consult the product Safety Data Sheet (SDS) for symptoms associated with a particular pesticide.

Pesticide on Skin

- **WASH, WASH, WASH! Immediately wash pesticide from skin as thoroughly as possible with any available water that does not contain pesticides.**
- Quickly remove protective clothing and any contaminated clothing.
- *Rewash* contaminated skin with soap and water as soon as possible.
- If the victim experiences *any* symptom(s) of poisoning, get medical assistance immediately. *Take the pesticide label with you*, but do not contaminate vehicles or expose others if you must take the container with you.

Pesticide in Eyes

- Rinse eye(s) gently with *clean* water for *at least* 15 minutes. Be careful of water temperature.
- **If eye remains irritated or vision is blurry after rinsing, get medical attention right away!** *Take the pesticide label with you*, but do not contaminate vehicles or expose others if you must take the container with you.

Pesticide in Mouth or Swallowed

- Provide / drink large amounts of water or milk to drink **-** *Do not give liquids to a person who is unconscious or convulsing!*
- Consult the label **BEFORE** vomiting is induced – the label may advise against inducing vomiting. Do not induce vomiting with emulsifiable concentrate (E, EC) formulations.
- *Do not induce vomiting if a person is unconscious or is convulsing!*
- **Seek medical attention.** *Take the pesticide label with you,* but do not contaminate vehicles or expose others if you take the container with you.
- If the pesticide was not swallowed, *rinse mouth thoroughly with clean water*. If mouth is burned or irritated, consult a physician.

Pesticide Inhaled

- Move victim to fresh air immediately!
- Warn others in the area of the danger.
- Loosen tight clothing.
- Administer artificial respiration if necessary, but try to determine if the person also may have swallowed any pesticide - avoid any pesticide or vomit that may be around the victim's mouth.
- **Seek medical attention.** *Take the pesticide label with you,* but do not contaminate vehicles or expose others if you take the container with you.

Heat Stress

- Move the victim to a cooler area, remove protective clothing, and pour cool water over the person.
- Give cool liquids to drink – *Do not give liquids to a person who is unconscious or convulsing!*
- **Pesticide poisoning may mimic heat illness!** Get medical attention if the person is unconscious or if the person is not fully recovered within 15 minutes of cooling down and drinking liquids.

Signal Words

The pesticide signal word will appear on the pesticide label. It provides information about the acute risks of the pesticide to people.

- **DANGER/POISON**: *Highly toxic* - less than a teaspoon can kill an adult.
- **DANGER**: *Highly toxic* - pesticide can cause severe eye and/or skin injury.
- **WARNING**: *Moderately toxic* - two tablespoons or less can kill an adult.
- **CAUTION**: *Slightly toxic* - an ounce or more is required to kill an adult.

Understand that the signal word does *not* provide information about long term pesticide exposure risks (*e.g.,* cancer) or allergic effects. Minimize your exposure to *all* pesticides. The signal word does *not* indicate environmental toxicity or other environmental effects.

PESTICIDE SPILLS AND ENVIRONMENTAL EMERGENCIES

Spills on public roads ***(Usually call the state police/state highway patrol.*** **In many cases you can call CHEMTREC at 1-800-424-9300 or 911.)**

STATE	AGENCY	PHONE NUMBER
Alabama	Alabama Highway Patrol Post Alabama Department of Environmental Management Alabama Emergency Management Agency	Cell: call ***HP** **(334) 271-7700** **(205) 280-2200**
Arkansas	Arkansas Department of Emergency Management	**1-800-322-4012**
Georgia	Georgia State Patrol	Cell: call ***GSP** *or* **911**
Louisiana	LDAF Emergency Hotline	**1-855-452-5323**
Mississippi	Mississippi Emergency Management Agency	**1-800-222-6362**
North Carolina	Regional Response Team (RRT) For spills not on public roadways, contact the Pesticide Section of NCDA&CS	**911** *or* your RRT **(919) 733-3556** *or* **(800) 662-7956** during non-business hours
South Carolina	South Carolina Highway Patrol South Carolina DHEC Emergency Response Section	Cell: call ***HP** **1-888-481-0125** (Toll Free)
Tennessee	Tennessee Emergency Management Agency (TEMA) State Emergency Operations Center	**1-800-262-3300**
Virginia	Virginia Emergency Operations Center	**1-804-674-2400**

Environmental emergencies (contamination of waterways, fish kills, bird kills, etc.)

STATE	AGENCY	PHONE NUMBER
Alabama	Alabama Department of Environmental Management Alabama Emergency Management Agency Alabama Department of Conservation and Natural Resources	**(334) 271-7700** **(205) 280-2200** **(334) 242-3469**
Arkansas	Arkansas Department of Emergency Management	**1-800-322-4012**
Georgia	Georgia Department of Natural Resources Response Team	**1-800-241-4113**
Louisiana	LDAF Emergency Hotline	**1-855-452-5323**
Mississippi	Mississippi Emergency Management Agency	**1-866-920-6362**
North Carolina	North Carolina Div. of Water Quality	**1-800-858-0368**
South Carolina	South Carolina DHEC	**1-888-481-0125**
Tennessee	Tennessee Wildlife Resources Agency	**Region 1 West Tennessee 1-800-372-3928** **Region 2 Middle Tennessee 1-800-624-7406** **Region 3 Cumberland Plateau 1-800-262-6704** **Region 4 East Tennessee 1-800-332-0900**
Virginia	Virginia Emergency Operations Center	**1-804-674-2400**

PESTICIDE LIABILITY AND STEWARDSHIP

The **Pesticide Environmental Stewardship** website is located at https://pesticidestewardship.org/. Information on proper pesticide use and handling, calibration of equipment, reading pesticide labels, disposal, handling spills, and other topics are presented.

Pesticide applicators, supervisors, and business owners may all face severe criminal and/or civil penalties if pesticides are misused – knowingly or accidentally.

The Pesticide Label. Federal and state laws require pesticide applicators to follow the directions on the pesticide label exactly. Do not exceed maximum label rates, apply a pesticide more frequently than stated on the label, or apply a pesticide to a site that is not indicated on the label. Labels change; review yours regularly.

Restricted Use Pesticides (RUP). These pesticides are clearly labeled "Restricted Use Pesticide" in a box at the top of the front label. Applicators purchasing, applying, or supervising the application of an RUP, must be certified or licensed through their state pesticide regulatory agency. Some states have mandatory licensing for certain pesticide use categories whether or not RUPs are applied.

Personal Protective Equipment (PPE). Anyone handling or applying pesticides must wear the PPE stated on the pesticide label. The Worker Protection Standard requires applicators to wear the label required PPE and requires agricultural employers to supply the label PPE and ensure that the PPE is worn correctly by applicator employees. Do not wear PPE items longer than it has been designed to protect you. Clean, maintain and properly store PPE. Do not store PPE with pesticides.

Reentry Interval (REI). The period of time immediately following the application of a pesticide during which unprotected workers should not enter a field.

Pre-Harvest Interval (PHI). The time between the last pesticide application and harvest of the treated crops.

EPA Worker Protection Standard (WPS). WPS changes continue to be implemented. Growers should consult the EPA website (https://www.epa.gov/pesticide-worker-safety/agricultural-worker-protection-standard-wps) or their local extension service for the most up to date information. Growers who employ one or more *non*-family members must comply with the WPS. This standard requires agricultural employers to protect applicator employees and agricultural worker employees from pesticide exposure in the workplace by 1) providing specified pesticide safety training, 2) providing specific information about pesticide applications made on the agricultural operation, 3) providing and ensuring that applicators wear clean and properly maintained label required PPE, 4) providing decontamination facilities for potential pesticide and pesticide residue exposures, and 5) providing timely access to medical assistance in the event of a suspected pesticide exposure. These protections apply to both Restricted Use *and* general use pesticides used in agricultural plant production.

***Enclosed Structures*:** Pesticides labeled for field applications may not be allowed for use in enclosed structures or may have additional restrictions. Definitions of enclosed structures differ between states but may include greenhouses and high tunnels. Consult your local Extension service or state Department of Agriculture for guidance and appropriate recommendations. WPS for enclosed structures may also differ than those for field-grown plants.

Pesticide Recordkeeping. You must keep records of all RUP applications for at least two years under the Federal (USDA) Pesticide Recordkeeping Requirement if your state does not have its own pesticide recordkeeping requirements. Some states require records be kept for longer than the federal requirement. Maintaining records of all pesticide applications, not just RUP applications, indefinitely, cannot only help troubleshoot application problems, but also allows you to reference successful applications and can help protect against future liability. Consult your local Extension Service for details.

Emergency Preparation. **Be prepared for emergencies.** Store pesticides and clean empty containers securely. Develop and provide written plans and training to prepare your employees and family members for pesticide fires, spills, and other emergencies. Assign responsibilities to be carried out in the event of pesticide emergencies. Keep copies of the pesticide labels and MSDS away from the area where pesticides are stored. Provide copies of product MSDSs to your community first responders. Consult your local Extension office and insurance company for assistance.

Pesticide Disposal. **Properly dispose of clean empty pesticide containers and unwanted pesticides as soon as possible.** Containers can often be recycled in a pesticide container recycling program. Unwanted pesticides may pose a risk of human exposure and environmental harm if kept for long periods of time. Consult your local Extension office for assistance.

GENERAL PESTICIDE INFORMATION

Mode of Action (MOA). Pesticides affect their target pest in a variety of ways, and the way a pesticide kills the target organism is called the ***mode of action* (MOA)**. Although pesticides have different names and may have different active ingredients, they may have the same MOA. Over time, pests can become resistant to a pesticide, and typically this resistance applies to all pesticides with the same MOA. When rotating pesticides, it is important to select pesticides with different MOAs.

FRAC/IRAC/WSSA Codes. The **Fungicide Resistance Action Committee** (FRAC), **Insecticide Resistance Action Committee** (IRAC) and IRAC Nematode Working Group, and the **Weed Science Society of America** (WSSA) have organized crop protection materials into groups with shared MOAs and given them specific codes, which appear on pesticide labels. Some MOAs may be unknown and given a code with a **U**. *When selecting pesticides, avoid successive applications of materials in the same MOA group to minimize potential resistance development*. MOA categories are listed in this guide to aid in the development of resistance management programs. More information about this topic can be found at **www.frac.info**, **www.irac-online.org**, and **www.hracglobal.com**.

Organic Materials Review Institute (OMRI; www.omri.org). Products that are listed by **OMRI** are commonly accepted for use in organically certified production systems. Always consult your organic certifier prior to use. **OMRI-listed** materials are indicated in the comments section.

Generics. Many pesticide active ingredients are available in generic formulations. For brevity, these formulations are not generally listed. Listed trade names are included to aid in identifying products and are not intended to promote the use of these products or to discourage the use of generic products. Generic products generally work similarly to their brand name counterparts, but formulation changes can impact efficacy and plant response. As with any new chemical, read and follow all label instructions. Chemical names are subject to change; please check the active ingredient for all materials.

Pesticide Environmental Stewardship. Information on pesticide use is available from the Pesticide Environmental Stewardship website (http://pesticidestewardship.org) including information on sprayer calibration, personal protective equipment, recordkeeping, and resistance management.

Resistance Management. Insects, weeds, and disease-causing organisms are all capable of developing resistance to pesticides. To minimize the likelihood of resistance development against your material of choice:

1. Only use pesticides when necessary: When the damage caused by the pest you are controlling is greater than the cost of the pesticide and no other, effective options are available.
2. Use the appropriate material for the pest.
3. Use the recommended rate of the material. Do not use a lower rate than listed on the label.
4. If more than one treatment is needed when the same pest is present, rotate pesticide MOA between treatments.

State registrations. Keep in mind that this publication is a regional guide. Every product listed may not be available or registered for use in every state. Before purchasing and applying a product, verify that that product is registered for use in your state. This may be done by visiting one of several online databases (examples provided below) that provide information on the state registration status of various products, by visiting product manufacturer websites, or by contacting your local county Extension agent or an appropriate state Extension specialist.

Database	Web Address
Agrian Label Database	https://home.agrian.com/
Crop Data Management Systems	http://www.cdms.net/Label-Database
EPA Pesticide Product and Label System	https://ordspub.epa.gov/ords/pesticides/f?p=PPLS:1
Greenbook Data Solutions	https://www.greenbook.net/
Kelly Registration Systems[1]	https://www.kelly-products.com/kelly-registration-systems/online-licensing-and-agriculture-permits-for-businesses-dealers-and-individuals/
National Pesticide Information Retrieval System[2]	https://www.npirs.org/state/

[1]Available for AL, FL, GA, MS, NC, SC, and VA in the southeastern U.S.
[2]Available for AL, AR, FL, KY, LA, TX, VA, and WV in the southeastern U.S.

CAUTION: Specific rates, application methods, and sometimes target pests vary on product labels containing the same active ingredient and are subject to change at any time. Always refer to and read the pesticide label before making any application!!

Formulation Abbreviations: Abbreviations commonly used in product formulations that appear in the tables include DF = dry flowable; EC = emulsifiable concentrate; EW = emulsion, oil in water; F = flowable; L = liquid; SC = spray concentrate; SL = soluble concentrate; EG, WG, or WDG = water dispersible granule; W or WP = wettable powder; and WSB = water soluble bag.

Other Abbreviations: Another abbreviation that may appear in product names is XLR = xtra long residual.

Efficacy Ratings: The efficacy of a management option is indicated by E = excellent, VG = very good, G = good, F = fair, P = poor, NA = not recommended. These ratings are benchmarks, actual performance will vary. A superscript 'R' (^{R}) next to the efficacy rating indicates that isolates with resistance to this fungicide have been identified in the southeastern U.S. If a pathogen with resistance to this fungicide is present, this fungicide will not be as effective as indicated.

POLLINATOR PROTECTION

Before making insecticide applications, monitor insect populations to determine if treatment is needed. If pesticide (fungicide or insecticide) application is necessary:

1. Use selective pesticides to reduce risk to pollinators and other non-target beneficial insects.
2. Read and follow all pesticide label directions and precautions. The label is the Law! EPA now requires the addition of a "Protection of Pollinators" advisory box on certain pesticide labels. Look for the bee hazard icon in the Directions for Use and within crop specific sections for instructions to protect bees and other insect pollinators.
3. Minimize infield exposure of bees to pesticides by avoiding applications when bees are actively foraging in the crops. Bee flower visitation rate is highest in early morning. Apply pesticides in the late afternoon or early evening to allow for maximum residue degradation before bees return the next morning. Bee foraging activity is also dependent upon time of year (temperature) and stage of crop growth. The greatest risk of bee exposure is during bloom.
4. Minimize off-target movement of pesticide applications by following label directions to minimize off target movement of pesticides. Do not make pesticide applications when the wind is blowing towards beehives or off-site pollinator habitats.

For specific pesticide hazard levels to honey bees, visit the table of "Commonly Used Pesticides Grouped According to Their Relative Hazards to Honey Bees" (pg. 48-50) in the *Georgia Pest Management Handbook* (https://extension.uga.edu/publications/detail.html?number=SB28-04).

SPRAYER EQUIPMENT CONSIDERATIONS FOR PESTICIDES

In addition to appropriate selection of pesticides for product efficacy and resistance management, proper application of products for disease, insect, and weed management requires appropriate selection and preparation of spray equipment for adequate spray coverage and canopy penetration. Without regard to the spray equipment utilized, nozzle selection and sprayer calibration are extremely important considerations. Calibration factors include tractor speed and pumping system pressure, and all producers need to understand how these factors impact spray coverage and product efficacy for each targeted use pattern.

Again, using an appropriate nozzle for the intended use is critical. Numerous nozzles of various shapes, sizes, and output (gallons per minute, GPM) are available for purchase. Nozzle selection will determine droplet size, GPM of the spray leaving the nozzle, and spray pattern. Droplet size not only affects product coverage and distribution on surfaces but also influences the potential for drift. For example, larger droplets have a reduced potential for drift than smaller droplets. It is, therefore, important to apply herbicides with sufficient droplet size to minimize drift. Smaller droplets, in comparison to larger droplets, increase spray distribution on surfaces and increase the chance for contact with fungal spores. Use of a nozzle that provides smaller (finer) droplet size may be beneficial when applying fungicides.

Routine sprayer calibration is necessary to achieve and maintain optimal performance of spray equipment and to insure the desired and precise output (gallons per acre, GPA) of the IPM products. Pressure losses in the pumping system can alter the exact GPM being applied. In addition, nozzles may wear over time, become plugged, break, or have a slightly different output than that listed in the catalog. It is best to calibrate spray equipment BEFORE the season begins; in-season calibration may also be needed, particularly if distribution differences, such as “skips,” or other problems are observed. Spray equipment should also be calibrated if nozzles are replaced or if adjustments to spray equipment, such as changes to sprayer pressure, are made.

Tractor speed should be set to allow for sufficient spray coverage of target plants/tissue. Moving too fast will minimize the amount of spray that is delivered to an area and may not allow for sufficient spray delivery to plants. Moving too slow may deliver an overabundance of spray to plants, essentially ‘wasting’ spray and increasing costs. Sprayer pressure may also need to be adjusted, as plants grow, to insure delivery of spray into plant canopies. Early-season applications will likely require less gallons of spray per acre than late-season applications, as the canopy increases in density and shoots grow.

Always conduct trials with water-sensitive cards scattered throughout the plant canopy to make sure you are getting the coverage you desire for the particular application, whether that be herbicides, insecticides, fungicides, etc. The time for determining whether the sprayer is effective is before applications are needed for insect, pathogen, or weed management.

For additional details on these topics, including example calculations for calibration of broadcast and banded sprayer applications, see the Nozzle Selection and Calibration Guide, available on the Southern Region Small Fruit Consortium website (https://smallfruits.org).

MyIPM App

A FREE smart phone app for Apple and Android devices that contains useful blackberry disease information (diagnostic key, photos, management guidelines, audio, and pesticide information) in support of this IPM guide. App content is updated by regional specialists and is available for download from the Apple App Store or the Google Play Store.

Identifying Blackberry Fruit Disorders

A guide to blackberry fruit disorders called "What Is Going On With My Blackberry Fruit?" is available at https://www.uaex.uada.edu/farm-ranch/crops-commercial-horticulture/horticulture/ar-fruit-veg-nut-update-blog/posts/fruitdisorders.aspx.

Blackberry Diagnostic Tool

A diagnostic tool available at https://berries.cals.ncsu.edu/blackberry-diagnostic-tool/ that includes information on insects, diseases, nutritional deficiencies, and physiological disorders.

Southern Fruitcast

The Southern Fruitcast is a podcast covering the people, technology and latest developments in small fruit production in the Southeast. (https://www.uaex.uada.edu/farm-ranch/crops-commercial-horticulture/horticulture/southern-fruitcast-podcast.aspx)

Southeast Regional Caneberry Production Guide

A production guide for southeastern US caneberry production is available at: https://content.ces.ncsu.edu/southeast-regional-caneberry-production-guide

Bugwood Image Database

The Bugwood Image Database (https://images.bugwood.org/) is an online database that includes high-quality images of many insects, diseases, and weeds. The database is comprised of various websites for specific pest problems, including websites for Insect Images, IPM Images (diseases), and Weed Images. Website users can browse the websites for images of specific crops or search for specific pests.

Brambles Scouting Guide

A scouting guide for problems of brambles is available at https://fruitscout.ca.uky.edu/ that includes information on diseases, insects, weeds, wildlife, and abiotic disorders.

University of Georgia Blackberry IPM Academy

Videos presentations presented as part of the University of Georgia IPM Academy for Blackberries (in coordination with the Southern Regional Small Fruit Consortium) are available at: https://ipm.uga.edu/category/presentations-and-trainings/blackberry-presentations/

Arkansas Blackberry School

A self-guided video course on the basics of commercial blackberry production is available at: https://www.uaex.uada.edu/farm-ranch/crops-commercial-horticulture/horticulture/commercial-fruit-production/blackberry-school.aspx

Seasonal 'at a glance' disease management options for caneberries

Developmental Stage	Delayed Dormant[a]	Shoots 6" long till Pre-Bloom	Early bloom[b]	Full Bloom[c]	Petal Fall	Cover Sprays	Pre-Harvest	Harvest	After Harvest
Disease (Registered fungicide)	**Anthracnose, Cane Blight, Spur Blight** (Lime Sulfur or Copper) **Phytophthora Root Rot** (Ridomil, Orondis Gold 200, Orondis Gold, ProPhyt, K-phite, Aliette)	**Anthracnose, Cane Blight, Spur Blight** (Cabrio, Abound, Pristine, Quilt Xcel, Captan) **Powdery Mildew** (Sulfur, Rally, Cabrio, Abound, Pristine, Quilt Xcel, Luna Tranquility, Prolivo 300SC) **Rusts** (Rally, Cevya, Abound, Cabrio, Pristine, Tilt, Quilt Xcel) **Leaf Spots** (Tilt, Cevya, Abound, Cabrio, Quilt Xcel, Pristine, Luna Tranquility)	**Anthracnose, Cane Blight, Spur Blight** (Cabrio, Abound, Pristine, Quilt Xcel, Captan) **Powdery Mildew** (Rally, Cabrio, Abound, Pristine, Quilt Xcel, Luna Tranquility, Prolivo 300SC) **Rusts** (Rally, Cevya Abound, Cabrio, Pristine, Tilt, Quilt Xcel) **Leaf Spots** (Tilt, Cevya, Abound, Cabrio, Quilt Xcel, Pristine, Luna Tranquility) **Botrytis** (Rovral, Nevado, Elevate, Switch, Pristine, Luna Tranquility, Ph-D, Kenja, Captan) **Rosette** (Switch, Abound, Pristine, Quilt Xcel)	**Anthracnose, Cane Blight, Spur Blight** (Cabrio, Abound, Pristine, Quilt Xcel, Captan) **Powdery Mildew** (Rally, Cabrio, Abound, Pristine, Quilt Xcel, Luna Tranquility, Prolivo 300SC) **Rusts** (Rally, Cevya, Abound, Cabrio, Pristine, Tilt, Quilt Xcel) **Leaf Spots** (Tilt, Cevya, Abound, Cabrio, Quilt Xcel, Pristine, Luna Tranquility) **Botrytis** (Rovral, Nevado, Elevate, Switch, Pristine, Luna Tranquility, Ph-D, Kenja, Captan) **Rosette** (Switch, Abound, Pristine, Quilt Xcel)	**Anthracnose, Cane Blight, Spur Blight** (Cabrio, Abound, Pristine, Quilt Xcel, Captan) **Powdery Mildew** (Rally, Cabrio, Abound, Pristine, Quilt Xcel, Luna Tranquility, Prolivo 300SC) **Rusts** (Rally, Cevya, Abound, Cabrio, Pristine, Tilt, Quilt Xcel) **Leaf Spots** (Tilt, Cevya, Abound, Cabrio, Quilt Xcel, Pristine, Luna Tranquility) **Botrytis** (Rovral, Nevado, Elevate, Switch, Pristine, Luna Tranquility, Ph-D, Kenja, Captan) **Rosette** (Switch, Abound, Pristine, Quilt Xcel)	**Anthracnose, Cane Blight, Spur Blight** (Cabrio, Abound, Pristine, Quilt Xcel, Captan) **Powdery Mildew** (Rally, Cabrio, Abound, Pristine, Quilt Xcel, Luna Tranquility, Prolivo 300SC) **Rusts** (Rally, Cevya, Abound, Cabrio, Pristine, Tilt, Quilt Xcel) **Leaf Spots** (Tilt, Cevya, Abound, Cabrio, Quilt Xcel, Pristine, Luna Tranquility) **Botrytis** (Rovral, Nevado, Elevate, Switch, Pristine, Luna Tranquility, Ph-D, Kenja, Captan) **Rosette** (Switch, Abound, Pristine, Quilt Xcel)	**Anthracnose, Cane Blight, Spur Blight** (Cabrio, Abound, Pristine, Captan) **Powdery Mildew** (Rally, Cabrio, Abound, Pristine, Luna Tranquility, Prolivo 300SC) **Rusts** (Rally, Cevya, Abound, Cabrio, Pristine) **Leaf Spots** (Cevya, Abound, Cabrio, Pristine, Luna Tranquility) **Botrytis** (Rovral, Nevado, Elevate, Switch, Pristine, Luna Tranquility, Ph-D, Kenja, Captan) **Rosette** (Switch, Abound, Pristine) **Orange Cane Blotch** (ProPhyt)	**Anthracnose, Cane Blight, Spur Blight** (Cabrio, Abound, Pristine, Captan) **Powdery Mildew** (Rally, Cabrio, Abound, Pristine, Luna Tranquility, Prolivo 300SC) **Rusts** (Rally, Cevya, Abound, Cabrio, Pristine) **Leaf Spots** (Cevya, Abound, Cabrio, Pristine, Luna Tranquility) **Botrytis** (Rovral, Nevado, Elevate, Switch, Pristine, Luna Tranquility, Ph-D, Kenja, Captan) **Rosette** (Switch, Abound, Pristine) **Orange Cane Blotch** (ProPhyt)	**Cane Blight** (see notes) **Powdery Mildew** (Rally, Cabrio, Abound, Pristine, Quilt Xcel, Luna Tranquility, Prolivo 300SC) **Rusts** (Rally, Cevya, Abound, Cabrio, Pristine, Tilt, Quilt Xcel) **Leaf Spots** (Tilt, Cevya, Abound, Cabrio, Quilt Xcel, Pristine, Luna Tranquility) **Phytophthora Root Rot** (Ridomil, Orondis Gold 200, Orondis Gold, ProPhyt, K-phite, Aliette) **Orange Cane Blotch** (ProPhyt)

[a]Delayed Dormant (swollen buds) to Green Tip, [b]Early bloom refers to when 5-10% of flowers are open, [c]Caneberry 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 cultivar.

Seasonal 'at a glance' arthropod management options for caneberries

Developmental Stage	Delayed Dormant	Shoots 6" long till Pre-Bloom	Pre-Bloom	Petal Fall	Cover Sprays	Pre-Harvest through Harvest	After Harvest
Insects Controlled (Insecticides & Miticides)	**Raspberry Crown Borer** (Altacor, Asana, Brigade) **Fire Ants** (Extinguish Professional Fire Ant Bait, Esteem Fire Ant Bait)	**Strawberry Clipper** (Sevin, Brigade, Danitol, Assail, Delegate, Entrust)	**Strawberry Clipper** (Sevin, Brigade, Danitol, Assail, Delegate, Entrust) **Stink Bugs** (Brigade, Mustang Maxx, Assail, Actara, Azera) **Flower Thrips** (Entrust, Delegate, Assail) **Blackberry Gall Midge** (Sevin, Brigade, Danitol, Assail, Delegate, Entrust) **Raspberry Cane Borer** (Malathion, Brigade)	**Aphids** (M-Pede, Actara, Assail, Admire) **Stink Bugs** (Brigade, Mustang Maxx, Assail, Actara, Azera) **Rednecked Cane Borer** (Brigade) **Rose Scale** (Admire, Assail)	**Spotted-wing Drosophila** (Exirel, Verdepryn, Brigade, Malathion, Entrust, Delegate, Danitol, Mustang, Mustang Maxx) **Stink Bugs** (Brigade, Mustang Maxx, Assail, Actara, Azera) **Rednecked Cane Borer** (Brigade) **Spider Mites** (Zeal, Savey, Light Summer Oils, Acramite, Portal, Kanemite) **Japanese Beetle, Blackberry Psyllid** (Sevin, Malathion) **Broad Mites** (Agri-Mek, Apta, Magister, Portal)	**Spotted-wing Drosophila** (Exirel, Verdepryn, Brigade, Malathion, Entrust, Delegate, Danitol, Mustang, Mustang Maxx) **Stink Bugs** (Brigade, Mustang Maxx, Assail, Actara, Azera) **Sap Beetle** (Bait Buckets) **Spider Mites** (Zeal, Savey, Light Summer Oils, Acramite, Portal, Kanemite) **Japanese Beetle** (Sevin, Malathion) **Broad Mites** (Agri-Mek, Apta, Magister, Portal)	**Raspberry Crown Borer** (Altacor, Asana, Brigade) **Fire Ants** (Extinguish Professional Fire Ant Bait, Esteem Fire Ant Bait) **Broad Mites** (Agri-Mek, Apta, Magister, Portal)

Insect and mite management – The pest management options recommended in this guide should provide a template for planning and carrying out IPM tactics. Consult your local Extension Service for details.

Pre-Transplant and Transplant Operations

Blackberries and raspberry terminology – Diseases of raspberries are generally the same as those of blackberries; recommended control measures are the same unless otherwise indicated. First-year canes are called primocanes, and a second-year cane that has emerged from dormancy is called a floricane. Blackberry cultivars may be erect, semi-erect, or trailing (procumbent). On primocane-fruiting cultivars, flowers and fruit develop on 1st-year canes. In floricane-fruiting cultivars, flowers and fruit develop on the 2nd-year canes.

Tissue-cultured plants – Several important caneberry diseases (including numerous viruses, crown gall, orange rust, etc.) are frequently spread by traditional propagation practices. By contrast, plants that are propagated by tissue-culture from plants cleaned-up in the laboratory are often disease free. Tissue culture involves the propagation of plants using small pieces of plant tissue which are then cultured in a nutrient medium under sterile conditions. For establishing new caneberry plantings in the Southeast, the utilization of tissue-cultured plants that have undergone this laboratory cleaning process is strongly advised.

Nematodes – Little is known about caneberry nematodes in the Southeast, but there are at least three reasons why nematodes can be potentially problematic for caneberries: (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) some nematodes spread caneberry viruses. September soil sampling gives the best assessments of root-knot, root-lesion, dagger and other significant nematodes of caneberries. All potential sites should be sampled well ahead of land preparation. Following fumigation, a two-month period is often required before planting. Relatively warm soil temperatures (>50°F) are also required for effective fumigation. Therefore, it is best to fumigate by late October to late November, depending on location. Some rotations with alternative crops may also reduce nematode populations; however, more research is needed in this area in the southeastern U.S. Post-plant nematicides are also available for blackberry, though there is no information relative to the efficacy of these products for blackberry systems.

Viruses – Caneberry viruses are particularly problematic, causing reduced vigor, yield, fruit quality, and possibly plant death. The symptoms of viruses are varied, but include distorted leaves, ringspots, yellow veins, crumbly fruit, and impacts on yield. 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. Cleaned tissue-cultured plants are more likely to be free of viruses and are 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 nematodes are dangerous.

Crown gall – All caneberries can be affected. Canker-like growths or galls 0.25 to 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 is recommended to help 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 is expected to result in disease reduction. 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 caneberries are not currently available. All caneberries 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. Wounds caused by cold damage can also increase the risk of infection. Allow root pieces to heal prior to planting. Prune when 2 to 3 days of clear, dry weather is expected. Avoid cultivation by using herbicides for weed control, but also avoid herbicide burn of stems.

Phytophthora root rot – Root rot is generally a problem of low, poorly drained sites. Provisions for adequate drainage must be made prior to planting! Site selection and/or proper bedding operations are essential cultural practices for control of this disease. Treatment with fungicides is not effective for reversing root rot damage on plants with severe symptoms.

The efficacy of a management option is indicated by E = excellent, VG = very good, G = good, F = fair, P = poor, NA = not recommended. These ratings are benchmarks, actual performance will vary.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Crown gall	***Agrobacterium tumefaciens* strain K-84** (Galltrol-A)	1 plate/gal water suspension (dip application)	P	12 hrs	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 caneberries are susceptible. Avoid wounding of roots during planting because injury is required for infection. **This product may not be labelled in all southeastern states.**
	***Agrobacterium radiobacter* strain K1026** (Nogall)	100 g/gal	P	0 hrs	0 days	One 100 g pack of Nogall, when mixed into 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. **This product may not be labelled in all southeastern states.**
Nematodes	**1,3-dichloropropene 39% + chloropicrin 60%** (Pic-Clor 60)	up to 48.6 gallons	VG	5 days		SEE LABEL FOR ADDITIONAL INFORMATION
	1,3-dichloropropene 20% + chloropicrin 80% (Pic-Clor 80)	up to 34 gallons	VG	5 days		SEE LABEL FOR ADDITIONAL INFORMATION
	metam sodium (Vapam, Sectagon 42) **metam potassium** (K-PAM HL)	75 gallons 62 gallons per treated acre	G G	See label See label		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 soil must 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 4-week interval between treatment and planting. More time may be required.**

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

Fumigation with Telone products. Telone products are 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 to 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. Though soil temperatures of 40 to 80˚F are required for use of Telone, 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 4 weeks from application to planting, and the 35 GPA rate would require 5 weeks. If soils are wet or they have a clay component, dissipation will be much slower. Plan for at least 6 to 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.

Dormant (prior to budbreak)

Anthracnose and cane and leaf rust – These can be reduced by dormant-season sanitation. Wild blackberries near commercial plantings should be destroyed (ideally, within ~0.25 miles). Caneberry plantings should be pruned to remove old floricanes immediately after harvest, and any new canes that show signs of disease or insect injury should also be removed. Remove and burn or bury prunings. Though difficult to accomplish, removal of old floricanes is essential to good sanitation in a caneberry planting.

Raspberry cane borer and rednecked cane borer – Infested canes should be either removed from the site or destroyed immediately after harvest; infested canes can also be removed during winter pruning and destroyed. Though flail mowing is assumed to be acceptable, make sure canes are ground very fine to allow for desiccation. Selective pruning is usually adequate for cane borer control.

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 canes. Leaves, flowers, and fruit may also 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 trailing (procumbent) types. Erect blackberry cultivars listed from more resistant to moderately susceptible are Shawnee, Navaho, Arapaho, Choctaw, Brazos. 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). Delayed dormant lime sulfur applications, in particular, are recommended for this disease. Spray once at green tip (when plants break dormancy) up until the point at which no more than ¾ inch green tissue has been formed. In plantings with a history of anthracnose, additional applications of other effective fungicides are recommended when primocanes are 6 inches tall and again at 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.

Cane blight – Typically, cane blight damage is closely associated with wounds. Visible symptoms of cane blight include lesions on primocanes and floricanes which can grow together, girdling the cane and resulting in cane death. Initially, lesions may be visible near wounds as dark red areas with purple borders. Lesions eventually become gray in appearance and may be silvery due to the presence of fungal spore masses that dry on the cane surface. Within lesions, fungal spore-producing structures may be evident as black bumps. Hosts affected: blackberry and raspberry (very susceptible). Fungicide applications during the dormant period may help reduce cane blight disease carryover from year to year. Additional applications may be necessary throughout the season after wounding events, and especially following after-harvest pruning. See "After-Harvest" section for additional information about cane blight management and fungicide recommendations following pruning events.

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 (removing and destroying) infested canes is very important. Late fall or late winter/early spring insecticide applications are necessary** to prevent raspberry crown borer larvae from boring into crowns as they emerge from their hibernacula in the early spring.

Fire ants – These can be nuisance pests in caneberry plantings. **Optimal fire ant control programs for fruit crops 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. Applications should be made on a warm sunny day when grass is dry and ants are actively foraging. Foraging activity can be gauged by placing a food item, such as a potato chip, near the mound for 30 minutes or disturbing the mount. If ants are feeding on the chip within 30 minutes, conditions are right to apply baits. Ideally, temperatures should be warm and sunny. Avoid application of ant baits when conditions are expected to be cold, overcast, rainy or very hot. Do not disturb mounds or place bait directly on top of mounds. **Treatment of individual mounds is often a necessary complement to prior broadcast bait use if the goal is to obtain short-term elimination of fire ants.** Extinguish Professional Fire Ant Bait and Esteem are very effective, but slow acting options (8 to 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. Insecticide mound drenches are most effective when 1 to 2 gallons of dilute material are slowly applied per mound.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Anthracnose, cane blight, and spur blight	**calcium polysulfide** (Brandt Lime Sulfur, Lime Sulfur Ultra, Lime Sulfur Solution, and Sulforix)	See specific product label	VG (Anthracnose) F (Cane blight and spur blight)	48 hrs	See label	Apply products at delayed dormant, but before shoots are ¾ inch long. Calcium polysulfide products are dangerous to the applicator, so use caution. Any exposed green tissue will likely be burned. **Follow specific label directions for dilutions, and never use in the concentrated/undiluted form.** Some products may be **OMRI-listed**, please consult your local organic certifier prior to use. **FRAC M2.**
	copper-based products	See specific product label	P	See label	See label	Multiple copper-based materials are available, including copper hydroxide, copper sulfate, and others. Apply prior to ¾ inch shoot stage to avoid leaf burn. Some products may be **OMRI-listed**, please consult your local organic certifier prior to use. For raspberries only: Copper can cause phytotoxicity on black raspberry cultivars if used with formulated phosphorous acid products (e.g. Aliette). It is also an occasional problem on red raspberries. **FRAC M1.**
Phytophthora root rot	**mefenoxam** (Ridomil Gold SL)	3.6 pt/A or 0.25 pt/1000 row feet	VG	48 hrs	45 days	Apply before the plants start to grow in the spring. One additional application may be made to coincide with the period most favorable for root rot development. **FRAC 4.**
	oxathiapiprolin (Orondis Gold 200)	4.8 to 9.6 fl oz	VG*	4 hrs	1 day	Make first application before plants start to grow in the spring. Make a second application during a period favorable for root growth and at least 7 days after the first application. See label for additional information. Make no more than 2 sequential applications of Orondis Gold 200 (or any other FRAC 49-containing product) before rotating to a fungicide with a different mode of action. Do not make more than two applications per year. *Indicated efficacy rating is tentative based on the performance of similar products and laboratory studies. **FRAC 49.**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Phytophthora root rot (continued)	**oxathiapiprolin** + **mefenoxam** (Orondis Gold)	25-56 fl oz	VG	48 hrs	45 days	Make first application before plants start to grow in the spring. Make a second application during a period favorable for root growth and at least 7 days after the first application. See label for additional information. For resistance management: Rotate the use of Orondis Gold or other Groups 49 and 4 fungicides within a growing season sequence with different groups that control the same pathogens. Do not make more than two applications per year. *Indicated efficacy rating is tentative based on the performance of similar products and laboratory studies. **FRAC 49+4.**
	phosphorous acid-based products (e.g. ProPhyt, K-Phite, Aliette WDG)	See specific label rates	VG	See label	See label	Apply the first foliar application after bud break with at least 1 to 3 inches of new growth. Apply in the fall at least 30 days prior to leaf drop. When applied prior to or after copper, the pH of the phosphorous acid-based spray solution should be raised to 6 or above. Do not use adjuvants which enhance pesticide penetration. For raspberries only: Phosphorous acid-based products can cause phytotoxicity on black raspberry cultivars and occasionally on red raspberries if used with copper products or foliar fertilizers. For raspberries and blackberries: Due to the acidic nature of phosphorous acid-based products do not use acidifying type compatibility agents. If spray adjuvants are used, test them before use to confirm compatibility. Use of these products with acidic water has been shown to cause damage in some commodities; water pH should be 6 or higher. **FRAC P07.**
Raspberry crown borer	**chlorantraniliprole** (Altacor 35WG)	3 to 4.5 oz	VG	4 hrs	3 days	**IRAC 28.**
	bifenthrin (Brigade 2EC and Sniper 2EC)	6.4 fl oz (soil drench)	VG	12 hrs	3 days	See label for application instructions. Drench applications are the most effective since they target young larvae and should be applied in the early spring (late-dormant) or fall (mid-late October is the best timing for Arkansas). Apply drench applications in at least 50 gallons of final spray solution per treated acre (use flood nozzles in a continuous band application directed to the base of the plants). **IRAC 3.**
	(Brigade 10WSB)	16 oz (soil drench)	VG	12 hrs	3 days	
	esfenvalerate (Asana XL)	9.6 fl oz	G	12 hrs	7 days	Use sufficient spray volume to assure good coverage of the lower portions of canes and crowns. **IRAC 3.**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Fire ants	**s-methoprene** (Extinguish Professional Fire Ant Bait)	1.0 to 1.5 lb/acre 3 to 5 tbsp/ 1000 sq ft 3 to 5 tbsp/ mound	VG	4 hrs	0 day	Apply on a warm sunny day when grass is dry and ants are actively foraging. Extinguish Professional Fire Ant Bait (0.5% methoprene) is a slow-acting bait; it will take several weeks for Extinguish Professional Fire Ant Bait to reach full efficacy. Extinguish Professional Fire Ant Bait is legal for use on 'crop land.' Caution: Extinguish bait with methoprene plus hydramethylnon is not labeled for use on crop land. **IRAC 7A.**
	pyriproxyfen (Esteem Ant Bait)	1.5 to 2.0 lb	VG	12 hrs	24 hrs	Apply on a warm sunny day when grass is dry and ants are actively foraging. Esteem Fire Ant Bait will take several weeks to reach full efficacy. **IRAC 7D.**

Shoots Six Inches Long and Before Blooms Open

General fungicide use and resistance management recommendations:

- Fungicides are mainly protectants and should be applied prior to the appearance of disease symptoms. Not all diseases are present on every farm. To avoid applying fungicides unnecessarily, learn to identify diseases by their symptoms, and keep records of those that occur on your farm.
- Use multi-site fungicides (e.g. captan) and limit the number of applications of at-risk fungicides (page 53). If at all possible, use fungicides of the same FRAC code only TWICE a year to maintain their efficacy. See Fungicide Mode of Action chart for additional resistance management program help.
- Always tank mix hydroxyanilide [FRAC group 17] fungicides with a multi-site fungicide, such as captan, to control resistant strains.
- For at-risk fungicides, alternate fungicidal mode of action at each spray.

Spray volume for leaf diseases – To obtain adequate coverage, apply fungicides in 100 to 150 gallons of water per acre for control of leaf diseases (rusts and leaf spots). Apply fungicides to both sides of the row; alternate-row spraying will NOT provide adequate disease control after the leaf canopy closes.

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 to 18 inches. Remove infected canes, recognized by weak growth and the presence of orange pustules. The cultivars Cherokee, Cheyenne, Comanche, Choctaw, Shawnee and Chickasaw (erect, thorny), Arapaho, Apache, Ouachita, Osage, and Natchez (erect, thornless) are considered resistant. The disease has also been observed on primocane-fruiting cultivars Prime-Ark Traveler and Prime-Ark Freedom. Wild blackberries should be eradicated within 0.25 mile of planting. Preventive fungicide applications are effective; however, once a plant shows symptoms, it must be removed and destroyed. **Note: Orange rust is often confused with cane and leaf rust which is a different disease requiring different management. Mobile and online resources including the MyIPM App or the Bramble Scouting Guide may be useful for helping differentiate between these two rust diseases.**

Cane and leaf rust – Hosts affected: blackberry. Symptoms: floricanes and primocane have yellow spores erupting from pustules on canes and leaves; Infected floricanes are stunted and delayed in development; rust can also 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 floricane removal, delay sprays until scouting indicates new infections of primocanes. Apply protectant sprays to primocanes in fields with a history of cane and leaf rust.

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. Losses are usually relatively minor. Heavily infected plants are not as vigorous, produce less fruit, and may be more susceptible to cold injury. The problem is generally more serious on blackberries.

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 cultivars are very susceptible if grown in the East. Powdery mildew fungicide treatments should begin at the first sign of disease and continue at 10- to 14-day intervals.

Strawberry clipper – This is a small 3/16 inch (5 mm) long reddish-brown weevil with bluish-black wing covers. Clippers lay a single egg inside a flower bud, and then girdle the bud, preventing it from opening and exposing the developing larva. The adult female then clips the stem so that the bud hangs down or falls to the ground. Generally, blackberries compensate well for bud loss due to clipper injury, but harvest can be delayed as a result of extensive injury. Treatment is rarely needed, because economically significant damage is rare. Please note that all insecticides listed for strawberry clipper control are highly toxic to honey bees and other pollinators; do not apply insecticides during bloom.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Anthracnose, cane blight, and spur blight	**pyraclostrobin** (Cabrio EG)	14 oz	E	12 hrs	0 days	No more than 2 sequential applications of Cabrio should be made before alternating with fungicides of different mode of action. Make no more than 4 applications of Cabrio or other strobilurins per season. **FRAC 11.**
	azoxystrobin (Abound FL) Numerous generics are also available	6 to 15.5 fl oz See label	E	4 hrs See label	0 days See label	Under conditions of high disease pressure, it is recommended to use the higher rate. No more than 2 sequential applications of azoxystrobin should be made before alternating with fungicides of a different mode of action. Make no more than 4 applications of azoxystrobin or other strobilurins per season. **FRAC 11.**
	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	E	12 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides of a different mode of action. Make no more than 4 applications of Pristine or other strobilurins per season. **FRAC 11+7.**
	azoxystrobin + propiconazole (Quilt Xcel)	14 to 21 fl oz	E	12 hrs	30 days	Application should begin prior to disease development and continue on a 14-day schedule. No more than 2 sequential applications of Quilt Xcel should be made before alternating with fungicides that have a different mode of action. Make no more than 3 applications of Quilt Xcel or other group 11 fungicides per season. **FRAC 11+3.**
	captan (various formulations)	See label	G (Anthracnose) F (Cane blight and spur blight)	48 hrs	3 days	SEE LABEL. **FRAC M4.**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	**pyraclostrobin** (Cabrio EG)	14 oz	VG[R]	12 hrs	0 days	**In some southeastern US locations, Pseudocercospora (leaf spot) has been reported to be resistant to strobilurin fungicides**. No more than 2 sequential applications of Cabrio should be made before alternating with fungicides of different mode of action. Make no more than 4 applications of Cabrio or other strobilurins per season. **FRAC 11.**
	azoxystrobin (Abound FL) Numerous generics are also available	6 to 15.5 fl oz See label	VG[R]	4 hrs See label	0 days See label	**In some southeastern US locations, Pseudocercospora (leaf spot) has been reported to be resistant to strobilurin fungicides**. Under conditions of high disease pressure, it is recommended to use the higher rate. No more than 2 sequential applications of azoxystrobin should be made before alternating with fungicides of a different mode of action. Make no more than 4 applications of azoxystrobin or other strobilurins per season. **FRAC 11.**
	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	VG[R]	12 hrs	0 days	**In some southeastern US locations, Pseudocercospora (leaf spot) has been reported to be resistant to strobilurin fungicides**. No more than 2 sequential applications of Pristine should be made before alternating with fungicides of a different mode of action. Make no more than 4 applications of Pristine or other strobilurins per season. **FRAC 11+7.**
	propiconazole (Tilt)	6 fl oz	VG	24 hrs	30 days	When applied for Septoria leaf and cane spot control, propiconazole has been shown to have activity against rust diseases as well. **FRAC 3.**
	mefentrifluconazole (Cevya)	4 to 5 fl oz	VG	12 hrs	0 days	Apply before onset of diseases and on a minimum interval of 7 days. Do not apply more than 15 fl oz (0.39 lb mefentrifluconazole) per acre per year. **FRAC 3.**
	azoxystrobin + propiconazole (Quilt Xcel)	14 to 21 fl oz	VG[R] (Cercospora and Pseudocercospora leaf spot) E (Septoria leaf spot)	12 hrs	30 days	**In some southeastern US locations, Pseudocercospora (leaf spot) has been reported to be resistant to strobilurin fungicides**. Application should begin prior to disease development and continue on a 14-day schedule. No more than 2 sequential applications of Quilt Xcel should be made before alternating with fungicides that have a different mode of action. Make no more than 3 applications of Quilt Xcel or other group 11 fungicides per season. **FRAC 11+3.**

Blackberry and Raspberry (continued) *Shoots Six Inches Long and Before Blooms Open (continued)*						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	**fluopyram + pyrimethanil** (Luna Tranquility)	16 to 27 fl oz	E (Septoria leaf spot) G (Cercospora and Pseudocercospora leaf spot)	12 hrs	0 days	Apply no more than 54.7 fl oz product per acre per year. Make no more than two sequential applications of group 7 or 9 fungicides. **FRAC 7+9.**
Pseudocercospora leaf spot only	**cyprodinil + fludioxonil** (Switch 62.5WG)	11 to 14 oz	F	12 hrs	0 days	Do not exceed 56 oz of product per acre per year. Make no more than two sequential applications before using another mode of action fungicide. **FRAC 9+12.**
	isofetamid (Kenja 400SC)	13.5 to 15.5 fl oz	F	12 hrs	7 days	Initiate applications prior to disease development and continue on a 14-day interval. When disease pressure is high use the high rate. Apply Kenja 400SC in sufficient water to obtain adequate coverage of the foliage. Spray volume will usually be 50 to 100 gallons per acre for dilute sprays and 5 to 10 gallons per acre for aerial sprays. For aerial applications, apply Kenja 400SC in a minimum of 5 gallons of water per acre. Do not make consecutive applications of Kenja 400SC or other Group 7 containing fungicides before rotating to a fungicide with a different mode of action. Do not apply the third application of Kenja 400SC within 28 days of the second application. **FRAC 7.**

Blackberry and Raspberry (continued)
Shoots Six Inches Long and Before Blooms Open (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Powdery mildew	**myclobutanil** (Rally 40WSP)	1.25 to 3 oz	E	24 hrs	0 days	Rally is registered for use on blackberry and raspberry. It 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- to 14-day schedule, depending on disease(s) and disease severity. Do not apply more than 10 oz per acre per season. **FRAC 3.**
	azoxystrobin + propiconazole (Quilt Xcel)	14 to 21 fl oz	E	12 hrs	30 days	Application should begin prior to disease development and continue on a 14-day schedule. No more than 2 sequential applications of Quilt Xcel should be made before alternating with fungicides that have a different mode of action. Make no more than 3 applications of Quilt Xcel or other group 11 fungicides per season. **FRAC 11+3.**
	pyraclostrobin (Cabrio EG)	14 oz	E	12 hrs	0 days	No more than 2 sequential applications of Cabrio should be made before alternating with fungicides of different mode of action. Make no more than 4 applications of Cabrio or other strobilurins per season. **FRAC 11.**
	azoxystrobin (Abound FL) Numerous generics are also available	6 to 15.5 fl oz See label	E	4 hrs See label	0 days See label	Under conditions of high disease pressure, it is recommended to use the higher rate. No more than 2 sequential applications of azoxystrobin should be made before alternating with fungicides of a different mode of action. Make no more than 4 applications of azoxystrobin or other strobilurins per season. **FRAC 11.**
	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	E	12 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. Make no more than 4 applications of Pristine or other strobilurins per season. **FRAC 11+7.**
	fluopyram + pyrimethanil (Luna Tranquility)	13.6 to 27 fl oz	VG	12 hrs	0 days	Apply no more than 54.7 fl oz product per acre per year. Make no more than two sequential applications of group 7 or 9 fungicides. **FRAC 7+9.**

Blackberry and Raspberry (continued) *Shoots Six Inches Long and Before Blooms Open (continued)*						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Powdery mildew (continued)	**pyriofenone** (Prolivo 300SC)	4 to 5 fl oz	VG*	4 hrs	0 days	For powdery mildew control, make fungicide applications prior to disease initiation on a 7- to 14-day schedule when conditions are favorable for disease development. Use the specified low rate and long interval when conditions favor disease development and disease pressure is low. Increase use to the highest listed rate and shortest interval under heavy disease pressure. Normal spray volumes range from 20 to 100 gallons per acre (GPA) for dilute ground sprays and 5 to 10 GPA for concentrate ground sprays and aerial applications. Do not make more than 2 sequential applications of PROLIVO 300SC fungicide or other group 50 containing fungicide before rotating to a fungicide with a different mode of action. Do not apply more than 16 fl oz/A/year (0.32 lb.a.i/A/year). Do not exceed 4 applications per year. *Indicated efficacy rating is tentative based on the performance of similar products and laboratory studies. **FRAC 50.**
	sulfur-based products (Kumulus DF and other products)	See label	G	24 hrs	not listed	Multiple formulations of sulfur are available. Repeat at 10-day intervals as necessary. **FRAC M2.**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Cane and leaf rust, orange rust, and yellow rust	**myclobutanil** (Rally 40WSP)	1.25 to 3 oz	E	24 hrs	0 days	Rally is also active against powdery mildew. Begin applications as early as bud break and continue applications on a 10- to 14-day schedule, depending on disease(s) and disease severity. Do not apply more than 10 oz per acre per growing season. **FRAC 3.**
	propiconazole (Tilt)	6 fl oz	E	24 hrs	30 days	When applied for Septoria leaf and cane spot control, propiconazole has been shown to have activity against rust diseases as well. **FRAC 3.**
	mefentrifluconazole (Cevya)	4 to 5 fl oz	E	12 hrs	0 days	Apply before onset of diseases and on a minimum interval of 7 days. Do not apply more than 15 fl oz (0.39 lb mefentrifluconazole) per acre per year. **FRAC 3.**
	azoxystrobin + propiconazole (Quilt Xcel)	14 to 21 fl oz	E	12 hrs	30 days	Application should begin prior to disease development and continue on a 14-day schedule. No more than 2 sequential applications of Quilt Xcel should be made before alternating with fungicides that have a different MOA. Make no more than 3 applications of Quilt Xcel or other group 11 fungicides per season. **FRAC 11+3.**
	azoxystrobin (Abound FL) Numerous generics are also available	6 to 15.5 fl oz See label	E	4 hrs See label	0 days See label	Under conditions of high disease pressure, it is recommended to use the higher rate. No more than 2 sequential applications of azoxystrobin should be made before alternating with fungicides of a different mode of action. Make no more than 4 applications of azoxystrobin or other strobilurins per season. **FRAC 11.**
	pyraclostrobin (Cabrio EG)	14 oz	E	12 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. Make no more than 4 applications of Cabrio or other strobilurins per season. For suppression only. **FRAC 11.**
	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	E	12 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. Make no more than 4 applications of Pristine or other strobilurins per season. For suppression only. **FRAC 11+7.**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Strawberry clipper	Treatment is rarely needed, because economically significant damage is rare. Please note that all insecticides listed for strawberry clipper control are highly toxic to honeybees and other pollinators; do not make bloom applications.					
	spinetoram (Delegate WG)	3.0 to 6.0 oz	VG	4 hrs	1 day	**IRAC 5.**
	spinosad (Entrust 80WP) (Entrust SC)	 1.25 to 2 oz 4 to 6 fl oz	VG	4 hrs	1 day	**OMRI-listed. IRAC 5.**
	bifenthrin (Brigade 2EC) (Brigade 10WSB) Numerous generics	 3.2 to 6.4 fl oz 8 to 16 oz See labels	VG	12 hrs	3 days	In hot conditions, EC formulations can cause phytotoxicity. **IRAC 3.**
	fenpropathrin (Danitol 2.4EC)	10.66 to 16 fl oz	G	24 hrs	3 days	In hot conditions, EC formulations can cause phytotoxicity. **IRAC 3.**
	acetamiprid (Assail 30SG)	4.5 to 5.3 oz	G	12 hrs	1 day	**IRAC 4A.**
	carbaryl (Sevin XLR)	1 to 2 qt	G	12 hrs	7 days	**IRAC 1A.**

Pre-Bloom (when flower buds show white)

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.

Raspberry cane borer – Injury is typically two circles of girdling punctures about 1.5 inches apart on young shoot tips. Larvae will tunnel downwards after eggs hatch. If shoot tips are removed after wilting appears, chemical control may not be needed. Insecticides may be applied just before bloom.

Stink bugs – Stink bugs are medium-to-large, shield-shaped insects that have piercing and sucking mouthparts. Several species are occasional pests of caneberries. They feed on the flower buds and developing fruits of many plant species. Monitor plants for the presence of stink bugs before deciding to apply insecticides.

Flower thrips – Flower thrips are small, cigar-shaped insects that are often quite abundant during bloom. Flower thrips may vector some plant viruses of caneberries. Insecticide applications are often not necessary because flower thrips rarely cause economic damage on caneberries.

Leafrollers and leaftiers – These are active, green caterpillars that feed on and either roll or tie together leaves. Leafrollers and leaftiers are rarely an economically significant pest that justifies treatment.

Pest/Problem	Management Options
Anthracnose, cane blight, and spur blight	Same as **Shoots Six Inches Long and Before Blooms Open**
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	Same as **Shoots Six Inches Long and Before Blooms Open**
Powdery mildew	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**
Strawberry clipper	Same as **Shoots Six Inches Long and Before Blooms Open**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Stink bugs	**bifenthrin** (Brigade 2EC) (Brigade 10WSB) Numerous generics	 3.2 to 6.4 fl oz 8 to 16 oz See labels	VG	12 hrs	3 days	In hot conditions, EC formulations can cause phytotoxicity. **IRAC 3A.**
	zeta-cypermethrin (Mustang Maxx)	4 fl oz	VG	12 hrs	1 day	Mustang Maxx is usually reserved for SWD control during the harvest period. Maximum number of applications is six. **IRAC 3A.**
	acetamiprid (Assail 30SG)	4.5 to 5.3 oz	G	12 hrs	1 day	**IRAC 4A.**
	thiamethoxam (Actara 25 WDG)	3 oz	G	12 hrs	3 days	**IRAC 4A.**
	pyrethrins + azadirachtin (Azera)	2 to 3 pt	F	12 hrs	0 day	In hot conditions, EC formulations can cause phytotoxicity. **OMRI-listed. IRAC 3A+ Unknown but multiple modes of action.**
Flower thrips	**spinosad** (Entrust 80WP) (Entrust SC)	 1.25 to 2 oz 4 to 6 fl oz	G	4 hrs	1 day	**OMRI-listed.** After Entrust dries it is of low risk to pollinators. If applied in the evening after bee foraging has stopped, Entrust may be safely applied up to first bloom. Apply as-needed the day before bloom. Entrust is a good choice for flower thrips and may be effective against gall midge and leaftiers. **IRAC 5.**
	spinetoram (Delegate 25WG)	3 to 6 oz	G	4 hrs	1 day	Applications should be avoided when pollinators are present in the field. Spinetoram is toxic to bees when they are exposed within three hours of application. **IRAC 5.**
	acetamiprid (Assail 30SG)	4.5 to 5.3 oz	G	12 hrs	1 day	Applications should be avoided when pollinators are present in the field. **IRAC 4A.**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Blackberry gall midge and leafroller or leaftier	**spinetoram** (Delegate WG)	3.0 to 6.0 oz	VG	4 hrs	1 day	**IRAC 5.**
	spinosad (Entrust 80WP) (Entrust SC)	 1.25 to 2 oz 4 to 6 fl oz	VG	4 hrs	1 day	**OMRI-listed. IRAC 5.**
	bifenthrin (Brigade 2EC) (Brigade 10WSB) Numerous generics	 3.2 to 6.4 fl oz 8 to 16 oz See labels	VG	12 hrs	3 days	In hot conditions, EC formulations can cause phytotoxicity. **IRAC 3.**
	fenpropathrin (Danitol 2.4EC)	10.66 to 16 fl oz	G	24 hrs	3 days	In hot conditions, EC formulations can cause phytotoxicity. **IRAC 3.**
	acetamiprid (Assail 30SG)	4.5 to 5.3 oz	G	12 hrs	1 day	**IRAC 4A.**
	carbaryl (Sevin XLR)	1 to 2 qt	G	12 hrs	7 days	**IRAC 1A.**
Raspberry cane borer	**bifenthrin** (Brigade 2EC) (Brigade 10WSB) Numerous generics	 3.2 to 6.4 fl oz 8 to 16 oz See labels	VG	12 hrs	3 days	In hot conditions, EC formulations can cause phytotoxicity. **IRAC 3A.**
	malathion (Malathion 8F) (Malathion 57EC)	 2 pt 1.5 to 3 pt	G	12 hrs	1 day	Under hot conditions, the 8F formulation is less likely to result in phytotoxicity. **IRAC 1B.**

Early Bloom (5-10% open flowers) Do Not Apply Insecticides During Bloom

Use extreme caution with bloom period treatments. Insecticides and fungicides can negatively impact bees. Do not treat unless economically significant populations of insects or mites are present. Apply all necessary bloom period treatments at dusk, when bees are not foraging, and allow for the maximum dry time possible between application and when foraging resumes.

Botrytis gray mold (*Botrytis cinerea*) – Gray mold spores are gray in color and form aerial structures that can be seen with a hand lens on flowers and ripening fruit. Hosts affected: Black and red raspberry (highly susceptible); some blackberry cultivars are 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. Postbloom and pre-harvest sprays for gray mold control are generally not required in blackberry unless weather is cool and wet. **The gray mold fungus has developed resistance to multiple fungicides, which makes resistance management imperative.**

Rosette (double blossom) – Hosts affected: Blackberries. The cultivars Apache, Ouachita, Natchez, Osage, and Navaho are largely resistant. Kiowa, Hull, Chester, Rosborough, and Loch Ness are moderately susceptible. Highly susceptible cultivars include Shawnee, Choctaw, Chickasaw and Black Satin. Symptoms: 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: Remove wild blackberries within 0.25 miles of planting. If you have a problem with double blossom, start sprays when rosettes are blooming and primocanes begin to grow. Prune out witches-brooms as they develop and before they flower. (Estimated labor to do this, if done regularly each year on the Shawnee cultivar, is 40 hr/A.) Remove and destroy floricanes promptly after harvest. If disease pressure is very high, cut all canes to 12 to 18 inches after harvest, fertilize heavily, and irrigate regularly to produce an adequate crop of canes. This procedure will reduce yields somewhat.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Anthracnose, cane blight, and spur blight	Same as **Shoots Six Inches Long and Before Blooms Open**					
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	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**					
Powdery mildew	Same as **Shoots Six Inches Long and Before Blooms Open** *The impact of sulfur applications at bloom is unknown, therefore sulfur-based products are not recommended at this time period.*					

Blackberry and Raspberry (continued) *Early bloom (5-10% open flowers) (continued)*						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Botrytis gray mold	**cyprodinil + fludioxonil** (Switch 62.5WG)	11 to 14 oz	E	12 hrs	0 days	Begin application at early bloom. Do not exceed 56 oz of product per acre per year. Make no more than two sequential applications before using another mode of action fungicide. **FRAC 9+12.**
	fenhexamid (Elevate 50WDG)	1.5 lb	E^{R}	12 hrs	0 days	Begin application at 10% bloom and continue through harvest. Avoid making consecutive applications of Elevate before switching to a fungicide with another mode of action. Do not apply more than 6.0 lb of material per acre per year. **Resistance to fenhexamid is an issue in many southeastern states and resistance management is recommended. Fenhexamid should always be applied with a protectant fungicide such as captan. FRAC 17.**
	fluopyram + pyrimethanil (Luna Tranquility)	16 to 27 fl oz	E	12 hrs	0 days	Apply no more than 54.7 fl oz product per acre per year. Make no more than two sequential applications of group 7 or 9 fungicides. **FRAC 7+9.**
	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	VG^{R}	12 hrs	0 days	Make no more than 2 sequential applications of Pristine before alternating with fungicides that have a different mode of action. Make no more than 4 applications of strobilurins per season. **Resistance to pyraclostrobin and boscalid is an issue in the Southeast, and resistance management is recommended. FRAC 11+7.**
	iprodione (Rovral 4F; Nevado 4F)	1 to 2 pt	G	24 hrs	0 days	Iprodione-based products must 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. **FRAC 2.**
	captan (various formulations)	See label	G	48 hrs	3 days	SEE LABEL. **FRAC M4.**

			Blackberry and Raspberry (continued) *Early bloom (5-10% open flowers) (continued)*			
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Botrytis gray mold (continued)	**isofetamid** (Kenja 400SC)	13.5 to 15.5 fl oz	G^{R}*	12 hrs	7 days	Initiate applications prior to disease development and continue on a 14-day interval. When disease pressure is high use the high rate. Apply Kenja 400SC in sufficient water to obtain adequate coverage of the foliage. Spray volume will usually be 50 to 100 gallons per acre for dilute sprays and 5 to 10 gallons per acre for aerial sprays. For aerial applications, apply Kenja 400SC in a minimum of 5 gallons of water per acre. Do not make consecutive applications of Kenja 400SC or other Group 7 containing fungicides before rotating to a fungicide with a different mode of action. Do not apply the third application of Kenja 400SC within 28 days of the second application. **Resistance to isofetamid is an issue in many southeastern states and resistance management is recommended. Isofetamid should always be applied with a protectant fungicide such as captan.** *Indicated efficacy rating is tentative based on the performance of similar products and laboratory studies. **FRAC 7.**
	polyoxin D zinc salt (Ph-D WDG) (OSO 5%SC)	6.2 oz 6.5 to 13 fl oz	G	4 hrs	0 days	Do not apply more than 6 applications of Ph-D (4.2 oz ai/A) per season. Use in alternation with fungicides with a different mode of action. **FRAC 19.** **OMRI-listed.** A rate of 6.5 fl. oz/acre may be used for preventative applications before onset of visible disease, in periods of low disease pressure, or in a tank mix with other fungicides for resistance management. Otherwise, use a rate of 13.0 fl. oz/acre. Do not apply more than 4.3 oz ai/A per season. Alternate with fungicides having a different mode of action. **FRAC 19.**

			Blackberry and Raspberry (continued) *Early bloom (5-10% open flowers) (continued)*			
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Rosette (double blossom)	**cyprodinil + fludioxonil** (Switch 62.5WG)	11 to 14 oz	E	12 hrs	0 days	Begin application at early bloom. 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. When used to manage other fungal diseases, Switch has been shown to have activity against rosette as well. **FRAC 9+12.**
	azoxystrobin (Abound FL) Numerous generics are also available	6 to 15.5 fl oz See label	E	4 hrs See label	0 days See label	Under conditions of high disease pressure, it is recommended to use the higher rate. No more than 2 sequential applications of azoxystrobin should be made before alternating with fungicides of a different mode of action. Make no more than 4 applications of azoxystrobin or other strobilurins per season. **FRAC 11.**
	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	E	12 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 or other strobilurins per season. When used to manage other fungal diseases, Pristine has been shown to have activity against rosette as well. **FRAC 11+7.**
	azoxystrobin + propiconazole (Quilt Xcel)	14 to 21 fl oz	E	12 hrs	30 days	Application should begin prior to disease development and continue on a 14-day schedule. No more than 2 sequential applications of Quilt Xcel should be made before alternating with fungicides that have a different mode of action. Make no more than 3 applications of Quilt Xcel or other group 11 fungicides per season. **FRAC 11+3.**

Full Bloom — Do Not Apply Insecticides During Bloom

Use extreme caution with bloom period treatments. Insecticides and fungicides can negatively impact bees. Apply all necessary bloom period treatments at dusk, when bees are not foraging, and allow for the maximum dry time possible between application and when foraging resumes.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Anthracnose, cane blight, and spur blight	Same as **Shoots Six Inches Long and Before Blooms Open**					
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	Same as **Shoots Six Inches Long and Before Blooms Open**					
Powdery mildew	Same as **Shoots Six Inches Long and Before Blooms Open** *The impact of sulfur applications at bloom is unknown, therefore sulfur-based products are not recommended at this time period.*					
Cane and leaf rust, orange rust, and yellow rust	Same as **Shoots Six Inches Long and Before Blooms Open**					
Botrytis gray mold	Same as **Early Bloom (5-10% open flowers)**					
Rosette (double blossom)	Same as **Early Bloom (5-10% open flowers)**					

Petal Fall

Rednecked cane borer – The rednecked cane borer is a ¼ inch long beetle with a black head and wing covers, and a reddish thorax. Adults are typically present in caneberries from May until June. Larval stage rednecked 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 rednecked 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 rednecked cane borer. Keep records to help refine pest management efforts in subsequent years.

Aphids – Aphids are infrequent pests in southeastern caneberries, and rarely require treatment.

Pest/Problem	Management Options
Anthracnose, cane blight, and spur blight	Same as **Shoots Six Inches Long and Before Blooms Open**
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	Same as **Shoots Six Inches Long and Before Blooms Open**
Powdery mildew	Same as **Shoots Six Inches Long and Before Blooms Open** *The impact of sulfur applications at bloom is unknown, therefore sulfur-based products are not recommended at this time period.*
Cane and leaf rust, orange rust, and yellow rust	Same as **Shoots Six Inches Long and Before Blooms Open**
Botrytis gray mold	Same as **Early Bloom (5-10% open flowers)**
Rosette (double blossom)	Same as **Early Bloom (5-10% open flowers)**
Stink bugs	Same as **Pre-bloom (when flower buds show white)**

Blackberry and Raspberry (continued) *Petal Fall (continued)*						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Aphids	**imidacloprid** (Admire Pro)	7 to 14 fl oz (soil application only) 2.8 fl oz (foliar application)	E	12 hrs	7 days	Do not apply pre-bloom or at bloom. Admire Pro can be applied to the soil or as a foliar treatment. Read the label carefully and exercise caution when making soil applications via irrigation. **IRAC 4A.**
	thiamethoxam (Actara 25WG)	2 to 3 oz	E	12 hrs	3 days	**IRAC 4A.**
	acetamiprid (Assail 30SG)	2.5 to 5.3 oz	VG	12 hrs	1 day	**IRAC 4A.**
	insecticidal soap (M-Pede)	2% solution	F	12 hrs	0 days	**OMRI-listed**
Rednecked cane borer	Remove galled canes		E			Galled canes should be removed in the spring/summer and during winter pruning.
	bifenthrin (Brigade 2EC) (Brigade 10WSB) Numerous generics	 3.2 to 6.4 fl oz 8 to 16 oz See labels	VG	12 hrs	3 days	In hot conditions, EC formulations can cause phytotoxicity. **IRAC 3A.**
Rose scale	**imidacloprid** (Admire Pro)	7 to 14 fl oz (soil application only) 2.8 fl oz (foliar application)	E	12 hrs	7 days	Sporadic problem in Virginia. Do not apply pre-bloom or at bloom. Admire Pro can be applied to the soil or as a foliar treatment. Read the label carefully and exercise caution when making soil applications via irrigation. Foliar applications timed to crawler emergence give best control. **IRAC 4A.**
	acetamiprid (Assail 30SG)	4.0 to 5.3 oz	G	12 hrs	1 day	Foliar applications timed to crawler emergence give best control. **IRAC 4A.**

Cover Sprays (fruit development period between petal fall and pre-harvest)

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. Blackberries one mile or more from conifers seldom have psyllid infestations. If possible, avoid planting caneberries within 250 yards of conifers. Timing varies with geography and site, but psyllids often move from conifers to caneberries from early- to mid-April. Foliar distortion is seen within 7 to 10 days. Treat 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 caneberry production.

Broad mite – By late-May, begin weekly scouting of blackberry fields looking for the first terminal damage (leaf bronzing and/or cupping). If found, remove leaflets from the first expanded terminal leaf from each of several damaged primocanes. Use a 20 to 30X magnification hand lens or stereomicroscope to check underside of each leaflet for presence of white, oval, spotted eggs or active broad mites: immatures are white and adult females are amber with white hourglass shape on back. If damage and broad mites are present, it is time to apply a miticide (see online at: https://www.uaex.uada.edu/publications/PDF/MP467.pdf).

Japanese beetles – Japanese beetles have metallic green wing covers, coppery undersides and a series of white tufts along the outside of the abdomen. Japanese beetles are social foliage and fruit feeders. They can be abundant following rains, which promote large, synchronous emergences of adults. Defoliation is of modest concern until 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.

Spider mites – Spider mites can be significant pests of caneberries. However, they typically do not reach damaging densities unless plants have previously been treated with broad spectrum (IRAC 1A or 3) insecticides which can flare existing mite populations. 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.

Spotted-wing drosophila (SWD) – SWD females preferentially lay their eggs in ripening and ripe fruit, and larvae (maggots) develop internally. SWD adults can be monitored with traps, but trap captures cannot be used to make treatment decisions at this time. In sites where SWD are present, weekly insecticide applications should be made beginning when fruit begins to ripen and should be made more frequently in the event of a rain. Fruit should be sampled on a weekly basis to check for larval presence as adult sampling may not predict fruit infestations and pesticide treatments may not necessarily prevent infestation, depending on environmental conditions and application methods. SWD populations increase rapidly from mid-summer through the fall. Fruit that is harvested during this period is at higher risk of infestation than fruit that is harvested earlier in the growing season. **Start insecticide applications for SWD when you observe SWD or when your fruit starts to color (green turning to red), whichever comes first. Fruit should be harvested as frequently and thoroughly as possible. Ripe fruit that remains on the plant after harvest results in infestation. Best times for application efficacy are at dawn and dusk.** Frequent harvests (harvest intervals of less than three days) can reduce issues with SWD. Maintaining good sanitation in the field by removing and destroying leftover fruit can help reduce SWD infestation. Cultural and physical methods such as exclusion netting, heavy pruning, and ground covers can help with SWD management. Cold storage is important for both disease and SWD management. Fruit should be kept as cold as possible for as long as possible (use horticultural recommendations which will not result in fruit damage), and this will result in larvae and eggs already present slowing or stopping development and some mortality.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Anthracnose, cane blight, and spur blight	Same as **Shoots Six Inches Long and Before Blooms Open**					
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	Same as **Shoots Six Inches Long and Before Blooms Open**					
Powdery mildew	Same as **Early Bloom (5-10% open flowers)**					
Cane and leaf rust, orange rust, and yellow rust	Same as **Shoots Six Inches Long and Before Blooms Open**					
Botrytis gray mold	Same as **Early Bloom (5-10% open flowers)**					
Rosette (double blossom)	Same as **Early Bloom (5-10% open flowers)**					
Stink bugs	Same as **Pre-bloom (when flower buds show white)**					
Rednecked cane borer	Same as **Petal Fall**					
Spider mites	**acequinocyl** (Kanemite 15 SC)	31 fl oz	E	12 hrs	1 day	Do not make more than two applications per year. **IRAC 20B.**
	bifenazate (Acramite 50WS)	0.75 to 1.0 lb	E	12 hrs	1 day	Acramite targets eggs, larvae, and adults. **IRAC 20D.**
	fenpyroximate (Portal)	2 pt	E	12 hrs	1 day	Apply by ground using a minimum of 30 gallons of water per acre. For vines with a heavy canopy or in high pressure situations, higher water volumes are recommended. Allow 14 days between applications. Do not make more than 2 applications per year. Do not apply more than 4.0 pints (0.20 lb ai) per acre per year. **IRAC 21A.**
	etoxazole (Zeal)	2 to 3 oz	G	12 hrs	0 day	Apply by ground as a full coverage spray in a minimum of 50 gals/A of water. Applications of Zeal Miticide must be done using enough carrier (water) to ensure thorough coverage of the crop's vegetative and reproductive parts, which mites are using for dispersal, feeding and reproduction. Higher volumes of water coupled with well calibrated equipment will help to provide better coverage. Best results are achieved when mite populations are low. Apply Zeal Miticide at or prior to threshold for your area but not greater than the maximum rate listed. Do not use below use rate 2.0 oz/A (0.09 lb ai/A) as this may result in poor control and contribute to the development of resistance to etoxazole among mite populations. **IRAC 10B.**

Blackberry and Raspberry (continued)
Cover Sprays (continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Spider mites (continued)	**hexythiazox** (Savey 50DF)	4 to 6 oz	G	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. Do not make more than one application per year. **IRAC 10A.**
	light, summer-weight horticultural oils	1 to 2% by volume	F	4 hrs	0 days	Summer oils are effective in moderating low mite populations pre-harvest. Do not allow oil sprays on adjacent crops to drift onto crops which have been or will shortly be treated with captan, carbaryl, or sulfur. DO NOT use oils within 14 days of using captan, carbaryl, or any sulfur containing material because of potential for fruit finish or phytotoxicity issues. **IRAC UN.**
Blackberry psyllids and Japanese beetles	**malathion** (Malathion 8F) (Malathion 57EC)	 2 pt 1.5 to 3 pt	G	12 hrs	1 day	Under hot conditions, the 8F formulation is less likely to result in phytotoxicity. **IRAC 1B.**
	carbaryl (Sevin XLR)	1 to 2 qt	G	12 hrs	7 days	**IRAC 1A.**
	acetamiprid (Assail 30SG)	4.5 to 5.3 oz	G	12 hrs	1 day	**IRAC 4A.**
Spotted-wing drosophila	**fenpropathrin** (Danitol 2.4EC)	10.66 to 16 fl oz	E	24 hrs	3 days	In hot conditions, EC formulations can cause phytotoxicity. Maximum number of applications is two. Best utilized early in the growing season when picking less frequently, but should be avoided later on when populations are high and frequent harvest is necessary. **IRAC 3.**
	zeta-cypermethrin (Mustang Max) (Mustang Maxx)	 4.3 fl oz 4 fl oz	E	12 hrs	1 day	Maximum number of applications is six. **IRAC 3A.**
	bifenthrin (Brigade 2EC) (Brigade 10WSB) Numerous generics	 3.2 to 6.4 fl oz 8-16 oz See labels	E	12 hrs	3 days	In hot conditions, EC formulations can cause phytotoxicity. Maximum number of applications is two. Best utilized early in the growing season when picking less frequently, but should be avoided later on when populations are high and frequent harvest is necessary. **IRAC 3.**
	spinetoram (Delegate 25WG)	3 to 6 oz	VG	4 hrs	1 day	Maximum number of applications is six; or 19.5 oz total of product. **IRAC 5.**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Spotted-wing drosophila (continued)	**spinosad** (Entrust 80WP) (Entrust SC)	 1.25 to 2 oz 4 to 6 fl oz	VG	4 hrs	1 day	**OMRI-listed.** Maximum number of applications is six; or 9 oz total of product. **IRAC 5.**
	cyantraniliprole (Exirel)	13.5 to 20.5 fl oz	VG	12 hrs	1 day	Minimum application interval 5 days. Up to 4 applications at 13.5 fl oz per acre can be made per season. **IRAC 28.**
	cyclaniliprole (Verdepryn 100SL)	8.2 to 11 fl oz	VG	4 hrs	1 day	Apply 11 fl oz rate for best results. Thorough coverage is essential to achieve best results. For best results apply 100-150 gallons water per acre. Restrictions: This product has been determined to have a short residual toxicity (RT25) time. Foliar application of this product is prohibited from onset of flowering until flowering is complete unless: The rate is limited to 0.054 lb. a.i./A and the application is made in the time period between 2 hours prior to sunset and 8 hours prior to sunrise. Make no more than 3 applications per year. Minimal interval between treatment is 5 days. **IRAC 28.**
	malathion (Malathion 8F) (Malathion 57EC)	 See labels 2 pt	G	12 hrs	1 day	Maximum number of applications is four for the 8F only; this is allowed under a 24C label in certain states. Check your individual state registration. Under hot conditions, the 8F formulation is less likely to result in phytotoxicity. **IRAC 1B.**
	***Chromobacterium substugae* strain PRAA4-1^T and spent fermentation media** (Grandevo WDG)	1-3 lb	F	4 hrs	0 day	Grandevo is **OMRI** listed biological insecticide. **IRAC UN.** For control of spotted-wing drosophila, apply Grandevo WDG at 3 lb. per acre at a maximum 7-day interval when adult flies are first observed. Depending upon insect pressure, applications can be made on a shorter interval and Grandevo WDG can be tank-mixed or rotated with other insecticides active against SWD. The addition of a spreader-sticker is recommended and a pH of 6-8 is recommended. There are no tank-mix restrictions.
	pyrethrins (Pyganic 5.0) (Pyganic 1.4)	 4.5 to 15.61 fl oz 16 to 64 fl oz	 F F	 0 hrs 0 hrs	 0.5 day 0.5 day	Pyganic is **OMRI** listed. **IRAC 3A.**
	non-viable Burkholderia spp. strain A396 (Venerate XC)	1-2 lb	F	4 hrs	0 day	Venerate is **OMRI** listed biological insecticide. **IRAC UNB.**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Spotted-wing drosophila (continued)	**hydrogen peroxide and peroxyacetic acid** (Jet-Ag)	3.9-7.8 fl oz per 5 gallons of water	F	4 hrs	0 day	Keep unprotected persons from treated area until sprays have dried. Jet-Ag controls yeast which is a food source for spotted wing drosophila, thereby significantly reducing populations of spotted wing drosophila. Thoroughly wet all surfaces of plant, upper and lower foliage, including stems, branches and stalks to ensure full contact with plant tissue. Apply as needed. Jet-Ag can be tank-mixed with Grandevo WDG at 2 lb./acre for enhanced control of SWD. **IRAC UN.**
Broad mites	**abamectin** (Agri-Mek SC)	3.5 fl oz + 0.1 to 0.5% v/v non-ionic surfactant (NIS)	E	12 hrs	7 days	Agri-Mek SC must be mixed with non-ionic surfactant activator (NIS) type wetting, spreading and/or penetrating spray adjuvant. Reapply miticide only if/when you detect new terminal leaf damage and leaflet samples average between one to five active broad mites per leaflet. **IRAC 6.**
	fenazaquin (Magister SC)	32 to 36 fl oz	VG	12 hrs	7 days	Do not make more than one application per year. Do not exceed application rate of 36 fl oz of product (0.48 lb a.i.) per acre per year. Do not apply this product until crop is through petal fall unless the conditions specified in the label have been met. SEE LABEL. **IRAC 21A.**
	fenpyroximate (Portal)	2 pt	VG	12 hrs	1 day	Apply by ground using a minimum of 30 gallons of water per acre. For vines with a heavy canopy or in high pressure situations, higher water volumes are recommended. Allow 14 days between applications. Do not make more than 2 applications per year. Do not apply more than 4.0 pints (0.20 lb ai) per acre per year. **IRAC 21A.**
	tolfenpyrad (Apta)	27 fl oz	G	12 hrs	1 day	Do not apply by air on caneberry. Apply by ground only, using a minimum of 25 gallons of water per acre. Do not apply more than 54.0 fl oz (0.57 lb ai) per acre per year. Do not make more than 2 applications per year. Allow at least 7 days between applications. **IRAC 21A.**

Pre-Harvest (14 days before anticipated first harvest)

Sap Beetles – Sap beetles are sometimes called picnic beetles and 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.

Orange cane blotch (Orange felt) – Orange cane blotch 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 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. Phosphonate fungicides, such as ProPhyt, are the only materials which consistently suppress this disease on blackberries. Copper products, though recommended on other commodities for similar algal diseases, do not show consistent or sufficient management of this disease. Blotches caused by this disease are not obvious on primocanes until late summer/early fall; however, recent evidence indicates that primocane infection occurs in the late spring. Phosphonate applications beginning in the late spring and early summer can reduce the numbers and sizes of blotches on primocanes.

Pest/Problem	**Management Options**
Anthracnose, cane blight, and spur blight	Same as **Shoots Six Inches Long and Before Blooms Open** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicide Quilt Xcel) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	Same as **Shoots Six Inches Long and Before Blooms Open** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicides Quilt Xcel and Tilt) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*
Powdery mildew	Same as **Shoots Six Inches Long and Before Blooms Open** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicide Quilt Xcel) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*
Cane and leaf rust, orange rust, and yellow rust	Same as **Shoots Six Inches Long and Before Blooms Open** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicides Quilt Xcel and Tilt) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*
Botrytis gray mold	Same as **Early Bloom (5-10% open flowers)**
Rosette (double blossom)	Same as **Early Bloom (5-10% open flowers)** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicide Quilt Xcel) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Orange cane blotch	**potassium phosphite** (ProPhyt)	4 pt	VG	4 hrs	0 days	Use a minimum of 40 to 50 gal/acre total spray volume. Ensure the spray solution has a pH > 5.5 to limit the possibility of phytotoxicity. Do not apply on plants when they are under water stress, or during severe weather conditions such as high or very low temperatures. Follow all label directions, as plant damage can potentially occur if not utilized correctly. **FRAC P07.**
Spotted-wing drosophila	Same as **Cover Sprays**					
Stink bugs	Same as **Pre-bloom (when flower buds show white)**					
Sap beetles	Bait Buckets		G			Dispose of baits outside of fields.
Spider mites	Same as **Cover Sprays**					
Japanese beetles	Same as **Cover Sprays**					
Broad mites	Same as **Cover Sprays**					

Harvest

Raspberry cane borer – The planting should be examined weekly during June and July. The existence of wilting tips characterized by two girdling rings identify attack by raspberry cane borer. Control is obtained by pruning out the infested canes by cutting a few inches below the bottom ring or below the larval tunnel when wilting is first apparent.

Fruit rots and fruit quality – Fungicides alone do not provide adequate control of fruit rots; proper harvesting and handling is essential. Pre- and post-harvest rots can be greatly reduced by timely, complete harvest of all ripe fruit on the plant, followed by rapid post-harvest cooling. DO NOT HANDLE FRUIT WHEN WET as this will greatly increase post-harvest rots. Use a short harvest interval to avoid overripe fruit. The presence of overripe fruit greatly increases the incidence of fruit rot and postharvest decay. Post-harvest cooling is critical and is best accomplished using partial-vacuum or forced-air systems that use fans to pull cold air through stacks of palletized fruit.

Pest/Problem	Management Options
Anthracnose, cane blight, and spur blight	Same as **Shoots Six Inches Long and Before Blooms Open** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicide Quilt Xcel) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	Same as **Shoots Six Inches Long and Before Blooms Open** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicides Quilt Xcel and Tilt) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*
Powdery mildew	Same as **Shoots Six Inches Long and Before Blooms Open** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicide Quilt Xcel) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*
Cane and leaf rust, orange rust, and yellow rust	Same as **Shoots Six Inches Long and Before Blooms Open** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicides Quilt Xcel and Tilt) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*
Botrytis gray mold	Same as **Early Bloom (5-10% open flowers)**
Rosette (double blossom)	Same as **Shoots Six Inches Long and Before Blooms Open** *Note that fungicides with PHIs longer than 14 days (such as the DMI fungicide Quilt Xcel) are inappropriate for use this close to harvest. Therefore, their use is NOT recommended at this time period.*
Orange cane blotch	Same as **Pre-Harvest**

After-Harvest (after all fruit has been harvested)

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 are expected. During the summer, "pinch off" or "tip" tender primocanes when they reach the desired height, as opposed to cutting. Multiple passes to head primocanes at the desired height are recommended to speed healing and avoid more significant wounding. 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 (QoI) fungicides (Pristine, Cabrio, Abound) should be applied immediately after each pruning to provide a protective barrier on the wound site until healing can occur. Rally, a DMI fungicide, has also shown efficacy when applied to pruning wounds for cane blight. Alternation of Rally and strobilurins would provide a good method of resistance management for this pathogen. See http://extension.uga.edu/publications/detail.html?number=C894 for additional information. **Cane blight is caused by the fungus *Leptosphaeria coniothyrium* (*Paraconiothyrium fuckelii*); however, recent work has shown that other fungal species may be capable of causing similar symptoms ("cane dieback") on caneberries in the Southeast.** Management practices for cane blight are also expected to help reduce issues with these other fungal species causing cane dieback, but variations in fungicide efficacy may be observed depending on which dieback-causing organism is present. Research in this area is ongoing.

Fusarium and other cane diseases have been observed in the southeast, but the pathology of these organisms is not well understood at this time. For diagnostic images of Fusarium wilt, see https://content.ces.ncsu.edu/fusarium-wilt-of-blackberry.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI	Comments
Leaf spots (Cercospora, Pseudocercospora, and Septoria)	Same as **Shoots Six Inches Long and Before Blooms Open**					
Powdery mildew	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**					
Cane blight	See information box above.					
Phytophthora root rot	Same as **Shoots Six Inches Long and Before Blooms Open**					
Orange cane blotch	Same as **Pre-Harvest**					
Fire ants	Same as **Delayed Dormant**					
Broad mites	Same as **Cover Sprays**					
Raspberry crown borer	Same as **Delayed Dormant** *After harvest, infested canes should be removed and heavily-infested plants rogued.*					
	Roguing infested canes		VG			Remove infested canes. Rogue heavily-infested plants after harvest.

Efficacy of selected fungicides against caneberry diseases (E = excellent, VG = very good, G = good, F = fair, P = poor, NA = not recommended) These ratings are benchmarks, actual performance will vary.

	Fungicide	FRAC MOA	Anthracnose	Spur Blight	Cane Blight	Botrytis (gray mold)	Rosette (double blossom)	Powdery Mildew	Rusts	Orange Cane Blotch	Leaf Spots (Cercospora, Pseudocercospora)	Leaf Spots (Septoria)	Phytophthora Root Rot
	copper (**numerous formulations**)	M1	P	P	P	NA	NA	NA	NA	NA	NA	NA	NA
	sulfur (**numerous formulations**)	M2	NA	NA	NA	NA	NA	G	NA	NA	NA	NA	NA
	calcium polysulfide **(Lime Sulfur, Sulforix)**	M2	**VG**	F	F	NA	NA	NA	NA	NA	NA	NA	NA
	captan **(Captan)**	M4	G	F	F	G	NA	NA	NA	NA	NA	NA	NA
	fosetyl-Al **(Aliette WDG)**	P07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**VG**
	mono and di-potassium salts of phosphorous acid **(K-phite)** or potassium phosphite **(ProPhyt)** *injury may occur*	P07	NA	NA	NA	NA	NA	NA	NA	**VG**	NA	NA	**VG**
	iprodione **(Rovral 4F; Nevado 4F)**	2	NA	NA	NA	G[R]	NA	NA	NA	NA	NA	NA	NA
DMIs	mefentrifluconazole **(Cevya)**	3	NA	NA	NA	NA	NA	**NA**	***E**	NA	***VG**	***VG**	NA
DMIs	myclobutanil **(Rally)**	3	NA	NA	G After pruning	NA	NA	**E**	**E**	NA	NA	NA	NA
DMIs	propiconazole **(Tilt)**	3	NA	NA	NA	NA	NA	NA	**E**	NA	**VG**	**VG**	NA
	mefenoxam **(Ridomil Gold)**	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**VG**
	isofetamid (**Kenja**)	7	NA	NA	NA	*G[R]	NA	NA	NA	NA	F	NA	NA
	fluopyram + pyrimethanil **(Luna Tranquility)**	7+9	NA	NA	NA	**E[R]**	NA	**VG**	NA	NA	G	**E**	NA
	cyprodinil + fludioxonil **(Switch)**	9+12	NA	NA	NA	**E**	**E**	NA	NA	NA	F	NA	NA
Strobilurins	azoxystrobin **(Abound)**	11	**E**	**E**	**E**	NA	**E**	**E**	**E**	NA	**VG[R]**	**VG**	NA
Strobilurins	pyraclostrobin **(Cabrio)**	11	**E**	**E**	**E**	NA	NA	**E**	**E**	NA	**VG[R]**	**VG**	NA
Strobilurins	pyraclostrobin + boscalid **(Pristine)**	11+7	**E**	**E**	**E**	**VG[R]**	**E**	**E**	**E**	NA	**VG[R]**	**VG**	NA
Strobilurins	azoxystrobin + propiconazole **(Quilt Xcel)**	11+3	**E**	**E**	**E**	NA	**E**	**E**	**E**	NA	**VG[R]**	**E**	NA
	fenhexamid **(Elevate)**	17	NA	NA	NA	**E[R]**	NA	NA	NA	NA	NA	NA	NA
	polyoxin D zinc salt **(Ph-D, OSO)**	19	NA	NA	NA	G	NA	NA	NA	NA	NA	NA	NA
	oxathiapiprolin (**Orondis Gold 200**)*	49	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**VG**
	oxathiapiprolin + mefenoxam (**Orondis Gold**)*	49+4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**VG**
	pyriofenone (**Prolivo 300SC**)*	50	NA	NA	NA	NA	NA	**VG**	NA	NA	NA	NA	NA

*Efficacy ratings for these products are tentative ratings based on the performance of similar products and laboratory studies.
[R]Isolates with resistance to this fungicide have been identified in the southeastern U.S. If pathogen with resistance to this fungicide is present, this fungicide will not be effective.

Efficacy of selected insecticides against caneberry insects (E = excellent, VG = very good, G = good, F = fair, P = poor, NA = not recommended) These ratings are benchmarks, actual performance will vary.

Insecticide	IRAC MOA	Raspberry Crown Borer	Fire Ants	Strawberry Clipper	Stink Bugs	Flower Thrips	Blackberry Gall Midge	Raspberry Cane Borer	Aphids	Rose Scale	Rednecked Cane Borer	Spotted-wing Drosophila	Spider Mites	Broad Mites	Blackberry Psyllid	Japanese Beetle
carbaryl **(Sevin XLR)**	1A	NA	NA	G	NA	NA	G	NA	NA	NA	NA	NA	NA	NA	G	G
malathion (**many formulations)**	1B	NA	NA	NA	NA	NA	NA	G	NA	NA	NA	G	NA	NA	G	G
bifenthrin **(Brigade 2EC)**	3A	**VG**	NA	**VG**	**VG**	NA	**VG**	G	NA	NA	**VG**	**E**	NA	NA	NA	NA
esfenvalerate **(Asana XL 0.66EC)**	3A	G	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
fenpropathrin **(Danitol 2.4EC)**	3A	NA	NA	G	NA	NA	G	NA	NA	NA	NA	**E**	NA	NA	NA	NA
pyrethrins + azadirachtin **(Azera)**	3A+ UN	NA	NA	NA	F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
zeta-cypermethrin **(Mustang; Mustang Maxx)**	3A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**E**	NA	NA	NA	NA
acetamiprid **(Assail 30SG)**	4A	NA	NA	G	G	G	G	NA	**VG**	G	NA	NA	NA	NA	NA	NA
imidacloprid **(many trade names)**	4A	NA	NA	NA	NA	NA	NA	NA	**E**	**E**	NA	NA	NA	NA	NA	NA
thiamethoxam **(Actara 25 WDG)**	4A	NA	NA	NA	G	NA	NA	NA	**E**	NA	NA	NA	NA	NA	NA	NA
Spinetoram **(Delegate WG 25%)**	5	NA	NA	**VG**	NA	G	**VG**	NA	NA	NA	NA	**VG**	NA	NA	NA	NA
spinosad **(Entrust 80WP; Entrust SC)**	5	NA	NA	**VG**	NA	G	**VG**	NA	NA	NA	NA	**VG**	NA	NA	NA	NA
abamectin **(Agri-Mek SC)**	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**E**	NA	NA
methoprene **(Extinguish Professional Fire Ant Bait 0.5%)**	7A	NA	**VG**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pyriproxyfen **(Esteem Ant Bait)**	7D	NA	**VG**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Efficacy of selected insecticides against caneberry insects (E = excellent, VG = very good, G = good, F = fair, P = poor, NA = not recommended) These ratings are benchmarks, actual performance will vary.

Insecticide	IRAC MOA	Raspberry Crown Borer	Fire Ants	Strawberry Clipper	Stink Bugs	Flower Thrips	Blackberry Gall Midge	Raspberry Cane Borer	Aphids	Rose Scale	Rednecked Cane Borer	Spotted-wing Drosophila	Spider Mites	Broad Mites	Blackberry Psyllid	Japanese Beetle
hexythiazox **(Savey 50DF)**	10A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	G	NA	NA	NA
etoxazole (**Zeal**)	10B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	G	NA	NA	NA
acequinocyl (**Kanemite 15 SC**)	20B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**E**	NA	NA	NA
bifenazate (**Acramite 50WS**)	20D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**E**	NA	NA	NA
tolfenpyrad (**Apta**)	21A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	G	NA	NA
fenpyroximate (**Portal**)	21A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**E**	**VG**	NA	NA
fenazaquin (**Magister SC**)	21A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**VG**	NA	NA
chlorantraniliprole **(Altacor 35WG)**	28	**VG**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cyantraniliprole (**Exirel**)	28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**VG**	NA	NA	NA	NA
cyclaniliprole (**Verdepryn 100SL**)	28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**VG**	NA	NA	NA	NA
horticultural oil **(various)**	UN	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	F	NA	NA	NA
insecticidal soap (**M-Pede**)	UN	NA	NA	NA	NA	NA	NA	NA	F	NA	NA	NA	NA	NA	NA	NA

Fungicide groups with high risk of resistance development (generally single site of action)

FRAC Code	Fungicide Group	Trade Name (active ingredient)
2	Dicarboximides	Rovral or Nevado (iprodione)
3	Sterol Demethylation Inhibitors (DMIs) or Sterol Biosynthesis Inhibitors	Cevya (mefentrifluconazole) Rally (myclobutanil) Tilt (propiconazole) Quilt Xcel (propiconazole; one component of a two-part mixture)
4	Phenylamides	Ridomil Gold (mefenoxam) Orondis Gold (mefenoxam; one component of a two-part mixture)
7	Succinate Dehydrogenase Inhibitors (SDHIs)	Pristine (boscalid; one component of a two-part mixture) Luna Tranquility (fluopyram; one component of a two-part mixture) Kenja (isofetamid)
9	Anilinopyrimidines	Switch (cyprodinil; one component of a two-part mixture) Luna Tranquility (pyrimethanil; one component of a two-part mixture)
11	Strobilurins or QoIs (Quinone outside inhibitors)	Abound (azoxystrobin) Quilt Xcel (azoxystrobin; one component of a two-part mixture) Pristine (pyraclostrobin; one component of a two-part mixture) Cabrio (pyraclostrobin)
12	PhenylPyrroles	Switch (fludioxonil; one component of a two-part mixture)
17	Hydroxyanilides	Elevate (fenhexamid)
19	Polyoxins	Ph-D or OSO 5%SC (polyoxin D zinc salt)
49	Piperidinyl-thiazole-isoxazolines or OxySterol Binding Protein Inhibitors	Orondis Gold 200 (oxathiapiprolin) Orondis Gold (oxathiapiprolin; one component of a two-part mixture)
50	Aryl-phenylketones	Provilo 300SC (pyriofenone)

Fungicide groups with low risk of resistance development (generally multiple sites of action)

FRAC Code	Fungicide Group	Trade Name (active ingredient)
M1	Coppers	Copper (numerous formulations)
M2	Sulfurs	Sulfur (numerous formulations)
M4	Phthalimides	Captan (captan)
P07	Phosphonates	Aliette (Fosetyl-Al) K-phite (Mono and di-potassium salts of phosphorous acid) ProPhyt (Potassium phosphite)

Weed Management

Weeds compete with caneberry plants for water, as well as nutrients. In order to maximize growth and survivability of young plants, weed control is essential from planting until cane growth stops in the fall. Research has shown that weeds are very competitive, even with mature canes, and they will reduce crop yields and reduce primocane number as well as development. The presence of weeds inhibits worker efficiency during harvest, pruning, and floricane removal.

In order to prevent competition, caneberry plants must be grown in a weed-free strip. Research has shown that the width of that strip needs to be at least 4 feet wide. The utilization of preemergence (PRE) and postemergence (POST) herbicides provides the most effective and economical means for controlling weeds, thus preventing economic losses associated with yield loss due to weed competition. Caneberry growers are fortunate in that a number of herbicides have been cleared for use in caneberry plantings within the past few years.

Herbicide Resistance Management

The development of herbicide-resistant weed species has increased significantly across the Southeast during the past few years. Lately, weed resistance to glyphosate has been the most common resistance development, largely related to the widespread planting of glyphosate-resistant crops. The utilization of herbicides that have differing modes of action (MOA) during the growing season or tank-mixing herbicides with differing MOA are strategies utilized to prevent herbicide-resistant weed development. As a means to assist growers with identifying herbicides having like MOA's, a number system, identifying herbicides by MOA, has been developed and is being utilized. In the table below there is an MOA number for each herbicide active ingredient; this should aide growers in making management decisions that will prevent the development of herbicide resistance or address options for managing a known resistant weed population that may be in or near the fruit planting.

Growers are encouraged to find at least two herbicide programs containing different herbicides to rotate on an annual basis. By rotating herbicide programs, growers not only minimize the risk of herbicide resistance development, they also minimize the likelihood of selecting for weeds that one herbicide program may not effectively control.

Blackberry and Raspberry Herbicides

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
PREPLANT/ SITE PREPARATION	**glyphosate** (Various formulations and brands)	See label for rate (1 to 2 lb ai/A)	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. **MOA 9.**
PREEMERGENCE Annual grasses and small seeded broadleaf weeds	**pendimethalin** (Satellite Hydrocap)	2 to 6 qt	Newly planted (once soil has settled after transplanting) and established plantings	24	Apply as directed spray for PRE control of annual grass and small seeded broadleaf weeds. Sequential applications may be used so long as the interval between applications is 30 days or more and total use does not exceed 6.3 qt/A in a 12 month period. Use in newly planted caneberries is allowed, see label for details. For broad spectrum PRE weed control tank mix with *simazine*, Zeus Prime, *rimsulfuron*, or Trellis. **MOA 3**.
	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. In areas prone to soil movement injury to ground cover planted in the row middles can occur. MOA 12.**
PREEMERGENCE Broadleaf weeds	**isoxaben** (Trellis SC) 4.16 SC	16 to 31 fl oz	Newly planted (once soil has settled after transplanting) and established plantings	12	Trellis may be tank mixed with oryzalin to provide residual control of annual grass weeds. Do not apply more than twice per crop year and total use rate cannot exceed 1.0 lb ai per acre (31 fl. oz) per crop year. For non-selective POST weed control, tank mix with paraquat. **MOA 29.**
PREEMERGENCE Annual weeds and some perennial weeds	**dichlobenil** (Casoron 4G) (Casoron CS)	100 lb 1.4 to 2.8 gal	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. The liquid formulation can be applied when high temperatures are 70 °F or less. Best results are achieved when applied to moist soil followed by overhead irrigation. DO NOT apply when shoot emergence is occurring. Liquid formulation may be tank mixed with other registered herbicides. **MOA 29.**

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
PREEMERGENCE Annual weeds and some perennial weeds (continued)	**indaziflam** (Alion 1.67 SC)	3.5 to 5 fl oz	Plantings established at least one year or longer	12	Apply **ONLY** as a dormant application between late fall and early spring prior to bud swell. Two applications may be applied so long as there are at least 90 days between applications. DO NOT use on caneberries grown in sand or soils having a gravel content more than 20%. Total use rate cannot exceed more than 7 fl oz/A in soils having < 1% OM or 10 fl oz/A in soils having ≥ 1% OM. DO NOT allow spray to contact green stems, flowers, fruit, or foliage or unacceptable injury may occur. Tank mix with paraquat for non-selective POST weed control. **MOA 29.**
PREEMERGENCE Broadleaf weeds and some annual grasses	**simazine** (Princep 4 L) (Princep Cal 90) or various generic formulations	2 to 4 qt 2.2 to 4.4 lb	Newly planted (use half rate and apply after transplanting once soil has settled) 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. DO NOT apply after fruit set. **MOA 5.**
	terbacil (Sinbar 80 WDG)	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 within 70 days of harvest.** Do not use loamy sand or sandy soils. Do not use on soils having less than 1 % organic matter. When tank mixed with paraquat, Sinbar will provide postemergence control of 1 to 2 inch tall horseweed. **MOA 5.**
	fluridone (Brake On! 1.2 EC)	21 to 43 fl oz	Plantings established 1 year or more	48	Apply as a directed spray for residual control of annual grass and broadleaf weeds. DO NOT apply more than 43 fl oz per acre per crop year or use in same area for more than 2 consecutive years. The PHI for Brake On! is 30 days. Sequential applications may be used so long as total use rate does not exceed 43 fl oz per acre per crop year. If using rates less than 32 fl. oz another PRE herbicide should be include as a tank mix partner. Rimsulfuron, Satellite HydroCap, and Simazine are tank mix options. For non-selective POST weed control tank mix with paraquat. **MOA 12**

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
PREEMERGENCE AND POSTEMERGENCE	**flumioxazin** (Chateau 51 SW) (Chateau EZ or Tuscany SC)	6 oz 6 fl. oz	Plantings established 1 year or longer	12	Apply as a directed to spray. Use ONLY a single application per year. Chateau has a 7 day PHI for caneberries. Tank mix with paraquat for non-selective POST weed control. DO NOT tank mix with Zeus Prime. **MOA 14.**
PREEMERGENCE AND POSTEMERGENCE Annual broadleaf and grass weeds. Yellow nutsedge	**sulfentrazone + carfentrazone** (Zeus Prime XC)	7.7 to 15.2 fl oz	Plantings established 2 years or more	12	Apply as directed spray to caneberries that have been established 2 years or longer. If applying in a band and 50% or less of the area is treated Zeus may be applied twice with in a 12 month period. Allow at least 60 days between applications. Zeus has a 3 day PHI. Spray water must have a pH from 5.0 to 9.0 for optimum herbicide performance. Tank mix with paraquat for non-selective POST weed control. Sequential applications of Zeus are the most effective on yellow nutsedge. See label for details. For broad spectrum residual control of annual grasses tank mix with oryzalin. Zeus has no postemergence activity on grass weeds. **MOA 14.**
PREEMERGENCE AND POSTEMERGENCE Annual broadleaf and grass weeds	**rimsulfuron** (Solida, Matrix, Grapple)	4 oz	Plantings established 1 year or longer	4	Rimsulfuron has POST and PRE activity on broadleaf and some grass weeds. For broad spectrum residual control, tank mix rimsulfuron with oryzalin, or diuron. For nonselective POST weed control, tank mix rimsulfuron with paraquat. Do not treat caneberries established less than 1 year. Rainfall for herbicide activation is necessary within 2 to 3 weeks of application. Do not apply within 14 days of harvest. The pH of spray solution should be in the range of 4 to 8. Rimsulfuron may be applied as a sequential application so long as total use rate does not exceed 4 oz/A per year and application is made in band to less than 50% of the row spacing. Apply prior to primocane emergence or after primocanes are 3 ft. tall to minimize primocane injury. If primocanes are emerged at time of application chlorosis and stunting will occur but they will recover after several weeks. Solida and Matrix are the ONLY rimsulfuron formulations cleared for use on caneberry in the Southeastern United States. **MOA 2.**

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
PREEMERGENCE **Broadleaf weeds**	**mesotrione** (Callisto, Motif)	3 to 6 fl oz	Plantings established 1 year or more.	12	Apply pre-bloom as a directed spray in raspberry or blackberry. Callisto has PRE and POST activity. Callisto may be applied at a rate up to 6 fl oz/A. Sequential applications of 3 fl oz/A may be applied so long there is at least 14 days or more between applications. The addition of COC at 1% v/v (1 gal per 100 gal of spray solution) is necessary for POST weed control. Care must be taken to make sure the adjuvant is not one that may injure caneberry leaves. **MOA 27.**
POSTEMERGENCE Non-selective control	**glyphosate** (Various formulations and brands)	Read product label for application rate (0.75 to 1.0 lb a.i./A)	Plantings established 1 year or more.	12	**EXTREME care must be taken to PREVENT glyphosate contact with the crop. Glyphosate will cause severe crop injury or death if it contacts caneberry plants.** Caneberries are least susceptible to injury when dormant or in early spring. Susceptibility increases from bloom until caneberries are completely dormant. Wiper applicators may be used for glyphosate application to weeds. **Do not apply within 14 days of harvest.** Some generic formulations require additional surfactant. **Roundup WeatherMax is not registered on raspberries. MOA 9.**
POSTEMERGENCE Non-selective control (continued)	**paraquat** (Gramoxone, Firestorm, Parazone, Paraquat Concentrate 3SL)	1.3 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. DO NOT make more than 5 applications per year. **MOA 22.**
POSTEMERGENCE Selected broadleaf weeds like pigweed, morningglory, lambsquater, purslane, nightshade, tropical spiderwort, and smartweed	**carfentrazone** (Aim 2EC)	0.8 to 2.0 oz 6.4 oz (for primocane suppression)	Newly planted (must use shielded/hooded application equipment) and established plantings	12	Aim may be tank mixed with other herbicides registered in caneberries. Do not allow spray solution to contact desirable vegetation, flowers/bloom, or fruit. Every precaution should be taken to avoid herbicide injury related to herbicide drift. Use rate should not exceed 25 oz/A per year and there must be at least a 14-day interval between applications. The addition of a non-ionic surfactant at 0.25% v/v (1 qt/100 gal. of spray solution) or crop oil concentrate at 1 to 2% v/v (1 to 2 gal/100 gal of spray solution) is necessary for optimum herbicide performance. Aim has a 15 day PHI. **MOA 14.**

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
POSTEMERGENCE Selective control of certain broadleaf and grass weeds	**quinclorac** (QuinStar 4L)	8.4 to 16.8 fl oz	Plantings established 1 yr or longer		Quinclorac provides postemergence control of barnyardgrass, crabgrass, hemp sesbania, morninglories, small alligatorweed, prickly lettuce, and field bindweed. Weeds need to be less than 2" tall. Do not apply more that 12 oz/A per application. Do not make second application before 30 days. Apply with crop oil at 2 pints per acre or non-ionic surfactant at labeled rates. Do not apply 30 days before harvest. **MOA 4/29.**
POSTEMERGENCE Annual and perennial grasses	**clethodim** (Select and various brands 2EC) (Select Max)	6 to 8 oz 12 to 16 oz	Newly planted and established 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. The **Select Max formulation** is labeled for bearing caneberries and can be applied up to within **7 days of harvest**. **All other clethodim formulations can only be used on nonbearing caneberries. MOA 1.**
POSTEMERGENCE Annual and perennial grasses (continued)	**fluazifop** (Fusilade DX)	12 to 24 oz	Newly planted and established plantings	12	Sequential applications will be necessary for perennial grass control. Add a non-ionic surfactant (1 qt/100 gal of water) or crop oil concentrate (1 gal./100 gal. of water). Fusilade has a 1 day PHI. Total use cannot exceed 48 fl. oz. per acre per year. DO NOT apply more than 24 fl. oz in a single application. **MOA 1.**
	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 cannot exceed 5 pt/A per year. **MOA 1.**

Suggested Herbicide Programs (Blackberry and Raspberry)

Crop Age	Fall (Oct/Nov)	Winter (February)	Spring (April/May)	Summer (As Needed)
Newly Planted	Glyphosate (preplant)		Pendimethalin (Once soil settles after transplanting)	Pendimethalin + Paraquat (May or June); Fusilade DX, or Poast, or Clethodim (as needed).
	Glyphosate (preplant)		Simazine (half rate) or Trellis + Pendimethalin	Paraquat or Aim (multiple applications as needed); Fusilade DX, Poast, or Clethodim (as needed)
Blackberry and Raspberry Established 1 or more years	Chateau + Paraquat		Sinbar + Rimsulfuron + Paraquat	Paraquat or Aim (multiple applications as needed); Select Max or Fusilade DX (as needed)
		Rimsulfuron + Sinbar + Paraquat	Simazine + Pendimethalin + Paraquat	Paraquat or Aim (multiple applications as needed); Select Max or Fusilade DX (as needed)
		Alion + Rimsulfuron + Paraquat	Zeus Prime* + Pendimethalin + Paraquat	Paraquat or Aim (multiple applications as needed); Select Max or Fusilade DX (as needed)
	Alion + Paraquat		Zeus Prime* + Pendimethalin + Paraquat	Paraquat or Aim (multiple applications as needed); Select Max or Fusilade DX (as needed)
		Alion + Rimsulfuron + Paraquat	Chateau + Paraquat	Paraquat (as needed); Select Max or Fusilade DX (as needed)
	Paraquat	Rimsulfuron + Sinbar + Paraquat	Chateau + Paraquat	Paraquat or Aim (multiple applications as needed); Select Max or Fusilade DX (as needed)

*Zeus Prime XC can only be used on plantings established 2 years or longer.

Weed Response to Blackberry and Raspberry Herbicides

	Annual Grasses					Annual Broadleaf Weeds																Perennial Weeds				
Herbicides	Crabgrass	Foxtails	Goosegrass	Panicum, Fall	Ryegrass, Annual	Chickweed	Dock	Galinsoga	Geranium, Carolina	Groundsel, Common	Henbit	Horseweed	Lambsquarters	Morningglory, Annual	Nightshades	Pigweed	Radish, Wild	Ragweed	Sida, Prickly	Smartweed	Spotted Spurge	Bermudagrass	Dandelion	Johnsongrass	Nutsedge, Yellow	Virginia Creeper
Preemergence																										
Alion	G	G	G	G	G	G	G	G	G	-	G	G	G	G	G	G	G	-	G	-	G	N	-	N	P	N
Brake On!	G	G	G	-	-	-	-	-	-	-	-	-	G	-	G	G	-	-	G	-	G	N	-	-	N	N
Callisto	F	-	-	-	-	E	-	E	-	-	-	E	E	-	-	E	-	E	-	E	-	-	-	-	-	-
Chateau	G	G	G	G	G	G	G	G	G	G	G	G	E	G	G	E	G	G	E	G	E	N	G	N	N	N
Pendimethalin	E	E	E	G	G	G	N	N	-	F	F	-	E	F	P	E	P	P	P	P	F	N	P	-	N	N
Simazine	F	G	G	F	G	G	-	G	F	F	G	G	E	F	G	G	E	G	F	G	P	N	P	-	N	N
Sinbar	G	G	G	G	G	E	G	G	G	G	G	E	E	G	G	G	G	G	G	G	E	P	F	P	F	N
Solicam	E	E	E	E	G	E	-	G	-	F	G	G	F	F	G	P	G	G	E	G	F	P	G	-	P	N
Trellis	N	N	N	N	N	E	P	G	G	F	E	G	E	P	E	E	E	E	G	E	G	N	N	N	N	N
Rimsulfuron	F	G	-	F	-	G	-	-	-	G	E	G	G	F	F	E	G	-	-	-	G	N	F	N	F	-
Zeus Prime	G	G	G	G	-	G	G	G	-	G	E	-	E	G	E	E	G	-	E	G	E	N	-	N	G	N
Postemergence																										
Aim	N	N	N	N	N	-	-	-	-	-	-	P	G	E	G	G	F	-	-	G	-	N	N	N	N	N
Callisto	-	-	-	-	-	E	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clethodim	E	E	E	E	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E	N	G	N	N
Fusilade	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E	N	G	N	N
Glyphosate	E	E	E	E	E	E	G	G	G	E	F	E	E	G	E	E	G	E	G	F	G	F	G	G	F	G
Paraquat	G	G	G	G	G	G	-	G	F	F	F	P	G	G	G	G	F	G	G	G	G	P	P	P	P	P
Poast	E	E	E	E	G	N	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E	N	G	N	N
QuinStar	G	G	-	-	-	-	-	-	-	-	-	-	F	E	-	-	-	F	-	-	-	N	F	-	N	N

E = excellent, G = good, F = fair, P = poor, N = no activity, - = no information

Postemergence Control of Bermudagrass and Johnsongrass

Perennial grasses like bermudagrass and Johnsongrass can be controlled with Poast, Fusilade, or clethodim. Successful use of grass-specific herbicides (Poast, Fusilade DX, clethodim) depends on several factors however the most critical is application timing relative to weed growth stage. Application timing varies with grass species and somewhat with the herbicide choice which is outlined in **Table 2**. Additional factors influencing the performance of these herbicides on perennial grasses include spray volume and soil moisture. Graminicides are systemic herbicides, they enter the plant and move through the vascular system to their targeted site of action. Systemic herbicides need to be applied in spray volumes that do not exceed 25 gal. of spray solution per acre. Higher volumes dilute the herbicide and may reduce their effectiveness. Weeds free of stress (drought, etc.) also respond best to systemic herbicides because the herbicide moves into plant and through its vascular system more readily. All of these herbicides require a second application for them to be effective. It is important that the second application be timed appropriately and when the weed has regrown from the initial herbicide application. The time between the first and second application can vary depending upon environmental conditions so this requires monitoring in order to get the second application applied timely.

Table 2. Appropriate Application Time for Perennial Grass Control

Herbicide	Bermudagrass		Johnsongrass		PHI
	1st Application	2nd Application	1st Application	2nd Application	
Poast	6 inches	4 inches	25 inches	12 inches	50 days
Select Max	3 to 6 inches	3 to 6 inches	12 to 24 inches	6 to 18 inches	7 days
Fusilade	4 to 8 inches	4 to 8 inches	8 to 16 inches	6 to 12 inches	1 day

Refer to product label for spray additive recommendations.

If you have questions regarding the use of these products in fruit crops, contact your local agent with Cooperative Extension Service. Complete herbicides labels and supplemental labels can be viewed online at www.cdms.net or http://agrian.com/home/ if you desire to obtain more information before choosing a herbicide.

Yellow Nutsedge Control

Yellow nutsedge has become an increasing problem and is difficult to control. Since the loss of the Sandea label, the most effective option for controlling yellow nutsedge is to utilize a herbicide program that incorporates Zeus Prime XC. Zeus Prime contains sulfentrazone, which is known to provide excellent control of yellow nutsedge and will reduce tuber viability. In addition to Zeus Prime, rimsulfuron has some POST activity on nutsedge as well. In order to maximize rimsulfuron activity on yellow nutsedge, sequential applications will be necessary. Refer to the rimsulfuron product labels for use information.

If you have questions regarding the use of these products in fruit crops, contact your local county agent with the Cooperative Extension Service. Complete herbicides labels and supplemental labels can be viewed online at www.cdms.net or http://agrian.com/home/ if you desire to obtain more information before choosing a herbicide.

Managing Wild Blackberry in Non-Cropland Areas Near Commercial Caneberry Plantings

Blackberry is a native species throughout the United States and thrives in non-cropland areas like ditch banks, abandoned fields, fence rows, field borders or cutover timber areas. Wild blackberries adjacent to commercial caneberry plantings need to be controlled because they are host plants for viral diseases vectored by insects and nematodes that can limit the commercial viability of a commercial caneberry planting. In addition to viral diseases, blackberries harbor fungal diseases like orange rust. Several herbicides effectively control wild blackberry however **EXTREME** caution must be taken to prevent drift, movement, or contact with the commercial planting. Failure to do so will result in severe crop damage or death. The two most available and effective herbicide options for killing weedy blackberry and other *Rubus* species are glyphosate (Roundup and other trade names) and triclopyr amine (Garlon 3A). Prior to using these products applicators must read and follow all label directions and restrictions.

Glyphosate (Various Brands and formulations).
Glyphosate is non-selective and will kill grass weeds as well as broadleaf and woody perennial plants. Blackberry is most susceptible when treated in late summer and fall with a 1.5% solution (2 fl oz of glyphosate per gallon of spray solution). Applications as late as Thanksgiving have been effective (90% control) in western North Carolina.

Triclopyr (Garlon 3A).
Wild blackberries can be controlled with Garlon 3A when applied to blackberries in the spring after leaves have fully expanded through late summer (mid-September). The use rate for Garlon 3A as a spot spray is a 1% solution (1.3 fl oz of Garlon 3A per gallon of spray solution). Triclopyr will not control grass weeds. It is effective on multiple species of woody perennial plants and vines including grapes. There are multiple herbicides that contain triclopyr some of which contain other herbicides like 2,4D ester that are prone to volatilize and increases the likelihood of herbicide movement onto desirable plants. These products should not be used around commercial blackberry plantings. DO NOT use triclopyr near water used for irrigation or along ditch banks that drain into irrigation water reservoirs. Application equipment should be cleaned thoroughly using ammonia water before using the sprayer around other plants. Broadleaf crops (grapes, blackberry, blueberry, soybeans, cotton, clover, and vegetables) are very sensitive to triclopyr so extreme care must be taken to avoid herbicide movement if these plants are being grown in close proximity to the application area. It is important to note plant back restrictions on triclopyr product labels since some crops/plants are very sensitive to triclopyr and injury can occur is plant restrictions on the herbicide label are not followed.

Wildlife Damage Prevention

Pest/Problem	Management Options
Efforts to control birds and other wildlife that damage fruit crops should be focused on the perimeter of the planting first, especially on the side(s) facing favorable wildlife habitat. This is where the first damage will be observed and, in some cases, it may be sufficient to head off the problem. However, don't discontinue monitoring for wildlife damage throughout the planting.	
Birds	Crop losses to birds appear to be increasing in small fruit crops. Not only do birds consume fruit, but the damage they cause can result in increased problems with fruit rots and other pests such as bees and yellow jackets. Several different types of birds can cause problems. Robins, starlings and mockingbirds are among the more common ones, but orioles, cedar waxwings and finches may also feed on small fruit crops. Feeding pressure will be heavier in fields that are close to roosting or nesting sites such as woodlands, hedgerows, grassy fields, power lines and individual trees. Birds may feed, fly to these resting sites, and then return to the crop later in the day. While birds can and do fly fairly long distances to feed, the farther they have to fly, the more apt they are to not find the fruit crop or to be distracted by another food source. The presence of a pond, creek or other water source nearby is another factor that may lead to increased feeding pressure. Typically, bird damage tends to be more severe in the earlier parts of the growing season, and damage lessens as the season progresses. There are several control techniques which may be of value in decreasing losses to birds. They include visual, auditory and chemical repellents and exclusion (netting). For any method to be successful, it must be instituted before birds establish a feeding pattern, which generally means that they should be in place and operating at the time that color change occurs in the fruit. With the exception of exclusion, no one method should be relied on for control. Birds are federally protected and lethal control methods are not generally available to growers. Non-lethal methods such as exclusion (netting) are often sufficient when properly installed. Visual deterrents are usually ineffective as birds quickly learn to ignore these stimuli. Auditory distress calls and chemical repellents can be more effective. Chemical repellents can impart an off-flavor to the fruit crop. **Auditory repellents** Auditory scare devices such as propane cannons, noise makers or distress calls may offer temporary relief for some types of birds. Regardless of which one or ones is/are used, the following points should be considered to attain the best results: - Assess the potential for objections to the noise from your neighbors. - Start before birds establish a feeding pattern. - Operate control devices beginning shortly before sunrise and continuing until just after sunset, as early and late in the day may be the most intense feeding times. - Vary the frequency, the direction and the timing in which auditory devices are operated. Propane cannons should not be fired at intervals closer than 3 minutes. - Consider using more than one type of auditory device and possibly combine them with visual repellents. - If using distress calls, it is essential to identify the type(s) of birds you want to discourage and get distress calls specific to them. - Reinforce the sense of danger by shooting (if allowed).

Pest/Problem	Management Options
Birds (continued)	**Visual repellents** Visual repellents include such things as scare eyes suspended above the crop, mylar tape on the canopy of the crop, aluminum pie pans, plastic owls and plastic snakes. These range from ineffective to moderately effective for a short period of time. Birds will get used to them quickly if they are not moved around or if another type of repellent is not used along with it. Yellow scare eyes suspended above the crop and allowed to move freely have been reported to have some impact on blackbirds, however, robins do not seem to be affected. **Chemical repellents** Methyl anthranilate is registered as a bird repellent. While it is sometimes advertised as a taste repellent, this is not exactly correct. When sprayed on a crop, it causes an unpleasant sensation in the bird's mouth. Methyl anthranilate is a naturally occurring material used in the food service industry. Early reports have been inconsistent in regards to its effectiveness. It has also been reported to impart an undesirable foxy flavor to certain grape varieties. Methyl anthranilate has a short residual, so frequent reapplication will be necessary to achieve lasting results. Results may vary depending on the type of birds. Combining with another type of deterrent may result in greater effect than when used alone. As with other types of deterrents, applications need to start before birds establish feeding patterns. **Exclusion** Exclusion (netting) is the only consistently effective method of reducing bird damage. Netting is more expensive than other types of deterrents and can require fair amounts of labor, so it may not be an economically viable alternative in all situations. Nets are either laid on the canopy of the crop or suspended from a framework over the crop. The fruiting area of the plant needs to be completely protected. Birds will enter the canopy of the plant from below the net if it is open under the plant. If used with care, nets can be maintained for use over several years. For crops requiring multiple harvests such as caneberries, suspending the netting over the crop and around the sides of the field will allow easier access to the crop. If nets are placed directly on the crop canopy, birds can perch on it and feed on berries below them. Wild turkeys are becoming more of a problem in many areas of the country. While there is no doubt that they do consume some fruit, some research has shown that the turkeys are often after insects instead of the fruit. They do not appear to like loud and/or distressing sounds. While netting will work, turkeys can tear holes in it for access to the fruit.
Deer	Deer can damage small fruit plantings by foraging on succulent new growth during the growing season or by eating fruit. In fall, bucks can damage plants by rubbing their antlers on stems and stalks. This is more of a problem in tree fruits than small fruits. Deer can also puncture plastic mulch and possibly the irrigation tape underneath, resulting in loss of weed control. Deer numbers are increasing and incidents of deer damaging crops are also increasing. Deer populations are increasing across most of their range. Hunting on neighboring properties can reduce local damage but neighboring hunting clubs may be actively working to increase deer populations. Locating the planting away from favorable habitat for deer will help to lessen losses. However, this is not generally possible; deer travel 1 to 1.5 miles and it is highly unlikely that anyone can locate plantings sufficiently far from suitable habitat. Several control options do exist. Determining which one or ones to use depends on the deer population, availability of other food sources, location of favorable habitat, the duration for which protection is needed, and the value of the crop to be protected.

Pest/Problem	Management Options
Deer (continued)	**Repellents** Both taste and smell repellents exist. Smell repellents include commercially available products or materials such as tankage, blood, putrefied egg solids, and certain soaps. Repellents will not provide long-term control and will not provide control when populations are high or alternate food sources are scarce. **Exclusion** Exclusion (fencing) is the only truly effective long-term control for deer damage prevention. Fences can be electrified or not. Deer will try to go under a fence, through a fence, or over it. For non-electrified fences, the lowest wire needs to be within 10 inches or less of the lowest point in the ground around the fruit crop planting and tight enough to prevent deer from pushing under it. Do not neglect ditches or other low spots in the ground around the field, because the deer will find them. While some deer can easily clear an 8 foot fence, generally 6 feet will be sufficient to deter most deer. Wire mesh fences are more desirable than multiple strands of barbed wire. Wire mesh fence up to 5-feet high with the addition of 3 single strand wires for a total of 8 feet will reduce costs. For electric fences, several different designs have been used and, under certain conditions, each can be effective. The simplest and least expensive electric fence uses a single high-tensile wire at about 30 inches above ground level. A solar charger can be used if access to electricity is not an option. Peanut butter can either be smeared on the wire or on aluminum foil strips which are then draped over the wire. Plastic flagging may also be tied to the fence to make it more visible to the deer. Deer are curious animals and will investigate the fence if they are not being chased. Touching the fence results in getting shocked and turning the deer away from the field being protected. The single-wire, baited fence is relatively inexpensive, easy to construct and often adequate to protect the crop. With high deer populations, when available alternate food sources are scarce or when deer have already established a feeding pattern in the area being protected, this fence may not be adequate. More substantial electric fences for deer control have multiple wires with the alternate wires being electrified. One design uses 5 wires and is constructed at a 45-degree angle facing away from the area to be protected. The bottom wire is within 10 inches of the ground and is electrified to keep deer from going under the fence. The middle wire is also electrified to prevent deer from going through the fence and the top wire, which may be only about 5 feet above ground is electrified to keep deer from going over the fence. A fence constructed in this manner presents a barrier to the deer that has height and depth, a combination that generally will discourage the deer from trying to enter the field. Poly Tape electric fence often used to contain cattle and horses works well for deer fences. Numerous other fence designs exist including a non-electrified mesh fence with a hot wire on top. If electric fences are used, it is important to keep weeds, grasses and other materials away from the fence to prevent it from shorting out and to increase its visibility. Contact your local county agent and/or state extension wildlife specialist for additional information.

Pest/Problem	Management Options
Voles	Small fruit plantings can provide favorable habitat for both tunneling pine voles and surface-feeding meadow voles or prairie voles. The raised beds that are often constructed and amended with organic materials to create favorable conditions for plants also can provide a good environment for pine voles to travel and feed. Likewise, grasses and weeds on top of the bed can provide cover for meadow voles and prairie voles to move and feed. When available, voles feed primarily on grasses, herbaceous plants, bulbs, and tubers. When these preferred sources become less available, they will feed on the bark and roots of trees and shrubs. Since the feeding damage may be just above the soil line or underground, depending on the type of vole, vole problems may not be detected until plants begin to decline. Vole populations tend to be cyclical, with highs and lows occurring over a 4-to-5-year period. Monitoring sites for the presence of voles should be done throughout the year. A small pile of soil beside a hole may signify the presence of a breather hole for pine vole tunnels. Spongy areas on the ground may be from tunnels underneath. Narrow, beaten-down trails in the sod or mulch may be runways for surface-feeding voles. Look for droppings in these trails as further evidence of vole presence. Dogs or cats hunting in the field might be further reasons to suspect elevated vole populations. Snap traps baited with peanut butter can be used to collect a vole for identification. Place the traps late in the day and check them in early morning to lessen chances of other animals springing the traps or removing the voles. For surface-feeding voles, place the trap with the bait in the runway and on a small patch of bare soil, scraping away mulch or thatch as needed. For pine voles, excavate a small section of a tunnel and place the trap in it. Covering the traps may lessen problems of other wildlife springing them. Be sure any covers will allow the traps to spring without being impeded. Concentration stations can be placed in the field in the latter part of summer. Place a board, shingle, or similar object on the grass next to a row and leave it undisturbed for a couple of weeks or more. The presence of tunnels under the station when you check it would be evidence of an active vole population. Later in the fall, rodenticides could be seeded in these tunnels to kill voles. The station would lessen the likelihood of non-target species getting the rodenticides. Do not put stations, traps, or baits on bare soils because voles avoid these areas. Keeping the floor of the planting and the area around it mowed closely on a frequent basis will help limit vole movement into the caneberry field as it would increase their exposure to predators. Cleaning up ditch banks, hedgerows, or overgrown areas adjacent to the planting will further discourage vole presence.

Pest/Problem	Management Options
Voles (continued)	If voles appear to be moving into the planting at a particular point in the field, more extensive trapping may be of benefit. If vole populations are high, the use of a rodenticide might be warranted. ZP Rodent Bait AG is a rodenticide made by Bell Laboratories, Inc. It contains 2 percent zinc phosphide and is a restricted-use chemical. The label stipulates its usage only during the dormant season: after final harvest and no later than the beginning of leaf emergence in the spring. Always follow label directions and observe proper safety precautions during application. The following information is from the Specimen Label - "ZP Rodent Bait AG, Bell Laboratories, Inc. **Bushberries and Caneberries** Use Restrictions: For control of meadow voles, prairie voles, and pine voles *(Microtus spp.)* in bush berries (highbush and lowbush blueberries), currants, elderberries, gooseberries, and huckleberries) and in caneberries (blackberries, red raspberries, black raspberries, loganberries, and cultivars or hybrids of these caneberries). Only apply the product during the dormant season: after final harvest and not later than the beginning of leaf emergence in the spring. Do not apply when ground is snow-covered. Do not apply by air. Minimum preharvest interval is 70 days. **Broadcast Baiting:** This product may be broadcast by cyclone seeder, or by hand. When applying by hand, throw tablespoon amounts (12 grams) into heavy cover along bushes, rock outcrops, and fence lines. Make up to 2 applications at a minimum interval of 21 days, at the rate of 6 to 10 pounds per acre (0.2 – 0.2 lb. ai/A)/ application. Maximum application per growing season is 20 lb. per acre (0.4 lb. ai/A)." "Even though a federal registration may have been obtained for a given pesticide product allowing the distribution and sale of the product within the United States, a state may have additional requirements that must be met before the pesticide product can be distributed or sold within that state. Requirements vary from state to state, therefore, you should check with your State Dept. of Agriculture to determine if the product in question is labeled for use in your state."

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