Southeast Regional Strawberry
INTEGRATED PEST MANAGEMENT GUIDE
FOCUSED ON PLASTICULTURE PRODUCTION

2023
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.
# Southeastern Region University Small Fruits IPM Contacts

<table>
<thead>
<tr>
<th>Auburn University</th>
<th>University of Florida</th>
<th>University of Kentucky</th>
<th>Mississippi State University</th>
<th>University of Tennessee</th>
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<tbody>
<tr>
<td>Extension website: <a href="http://www.aces.edu/">www.aces.edu/</a></td>
<td>Extension website: sfyl.ifas.ufl.edu/</td>
<td>Extension website: extension.ca.uky.edu/</td>
<td>Extension website: extension.msstate.edu/</td>
<td>Extension website: utextension.tennessee.edu/</td>
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<tr>
<td>Elina Coneva (Horticulture)</td>
<td>Johan Desaeger (Nematology)</td>
<td>Daniel Becker (Horticulture)</td>
<td>John Byrd (Weed Science)</td>
<td>Zach Hansen (Pathology)</td>
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<tr>
<td>Ed Sikora (Pathology)</td>
<td>Phil Harmon (Pathology)</td>
<td>Ric Besson (Entomology)</td>
<td>Blake Layton (Entomology)</td>
<td>David Lockwood (Horticulture)</td>
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<tr>
<td>Edgar Vinson (Horticulture)</td>
<td>Oscar Liburd (Entomology)</td>
<td>Nicole Gauthier (Pathology)</td>
<td>Rebecca A. Melanson (Pathology)</td>
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<tr>
<td>University of Arkansas</td>
<td>Natalia Perez (Pathology)</td>
<td>Patsy Wilson (Grapes, Horticulture)</td>
<td>Eric Stafne (Horticulture)</td>
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</tr>
<tr>
<td>Extension website: uaex.uada.edu/</td>
<td>Jeff Williamson (Horticulture)</td>
<td>Shawn Wright (Weed Science, Horticulture)</td>
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<tr>
<td>Matt Bertucci (Horticulture)</td>
<td>University of Georgia</td>
<td>University of Kentucky</td>
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<td>Virginia Tech</td>
</tr>
<tr>
<td>Aaron Cato (IPM)</td>
<td>Extension website: extension.uga.edu/</td>
<td>Extension website: extension.ca.uky.edu/</td>
<td></td>
<td>Extension website: ext.vt.edu/</td>
</tr>
<tr>
<td>Amanda McWhirt (Horticulture)</td>
<td>Zilfina Rubio Ames (Horticulture)</td>
<td>Extension website: extension.ca.uky.edu/</td>
<td>Zach Hansen (Pathology)</td>
<td>Jeff Derr (Weed Science)</td>
</tr>
<tr>
<td>Ioannis Tzanetakis (Virology)</td>
<td>Brett Blaauw (Entomology)</td>
<td>Mary Helen Ferguson (Pathology)</td>
<td>David Lockwood (Horticulture)</td>
<td>Mizuho Nita (Pathology)</td>
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<tr>
<td>Hannah Wright (Weed Science)</td>
<td>Phil Brannen (Pathology)</td>
<td>Kathryn Fontenot (Horticulture)</td>
<td>Doug Pfeiffer (Entomology)</td>
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<tr>
<td>Clemson University</td>
<td>Mark Czarnota (Weed Science)</td>
<td>Raghwinder (Raj) Singh (Pathology)</td>
<td>Jayesh Samtani (Horticulture)</td>
<td>Yuan Zeng (Pathology)</td>
</tr>
<tr>
<td>Extension website: clemson.edu/extension/</td>
<td>Elizabeth Little (Organic Pathology)</td>
<td>Ron Strahan (Weed Science)</td>
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<tr>
<td>Tom Bilbo (Entomology)</td>
<td>Wayne Mitchem (Weed Science)</td>
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<tr>
<td>Brett Blaauw (Entomology)</td>
<td>Jonathan Oliver (Pathology)</td>
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<tr>
<td>Wayne Mitchem (Weed Science)</td>
<td>Glen Rains (Entomology)</td>
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<td>Guido Schnabel (Pathology)</td>
<td>Ash Sial (Entomology)</td>
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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 Material Safety Data Sheet (MSDS or 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 min. 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 must 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 Emergencies (cont’d)

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 must 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 min 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.
  o DANGER/POISON: Highly toxic—less than a teaspoon can kill an adult.
  o DANGER: Highly toxic—pesticide can cause severe eye and/or skin injury.
  o WARNING: Moderately toxic—2 tablespoons or less can kill an adult.
  o CAUTION: Slightly toxic—1 oz 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 CHEMTREK at 1-800-424-9300 or 911.)

<table>
<thead>
<tr>
<th>State</th>
<th>Agency</th>
<th>Phone Number</th>
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<tbody>
<tr>
<td>Alabama</td>
<td>Alabama Highway Patrol</td>
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<tr>
<td></td>
<td>Alabama Department of Environmental Management</td>
<td>(334) 271-7700</td>
</tr>
<tr>
<td></td>
<td>Alabama Emergency Management Agency</td>
<td>(205) 280-2200</td>
</tr>
<tr>
<td>Arkansas</td>
<td>Arkansas Department of Emergency Management</td>
<td>1-800-322-4012</td>
</tr>
<tr>
<td>Georgia</td>
<td>Georgia State Patrol</td>
<td></td>
</tr>
<tr>
<td>Louisiana</td>
<td>LDAF Emergency Hotline</td>
<td>1-855-452-5323</td>
</tr>
<tr>
<td>Mississippi</td>
<td>Mississippi Emergency Management Agency</td>
<td>1-800-222-6362</td>
</tr>
<tr>
<td>North Carolina</td>
<td>Regional Response Team (RRT)</td>
<td>911 or your RRT</td>
</tr>
<tr>
<td></td>
<td>For spills not on public roadways, contact the Pesticide Section of</td>
<td>(919) 733-3556 or (800) 662-7956 during non-</td>
</tr>
<tr>
<td></td>
<td>NCDA&amp;CS</td>
<td>business hours</td>
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<tr>
<td>South Carolina</td>
<td>South Carolina Highway Patrol</td>
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<tr>
<td></td>
<td>South Carolina DHEC Emergency Response Section</td>
<td>1-888-481-0125</td>
</tr>
<tr>
<td>Tennessee</td>
<td>Tennessee Emergency Management Agency (TEMA) State Emergency Operations Center</td>
<td>1-800-262-3300</td>
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<tr>
<td>Virginia</td>
<td>Virginia Emergency Operations Center</td>
<td>1-804-674-2400</td>
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#### Environmental Emergencies
(contamination of waterways, fish kills, bird kills, etc.)

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<tr>
<td></td>
<td>Alabama Emergency Management Agency</td>
<td>(205) 280-2200</td>
</tr>
<tr>
<td></td>
<td>Alabama Department of Conservation and Natural Resources</td>
<td>(334) 242-3469</td>
</tr>
<tr>
<td>Arkansas</td>
<td>Arkansas Department of Emergency Management</td>
<td>1-800-322-4012</td>
</tr>
<tr>
<td>Georgia</td>
<td>Georgia Department of Natural Resources Response Team</td>
<td>1-800-241-4113</td>
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<tr>
<td>Louisiana</td>
<td>LDAF Emergency Hotline</td>
<td>1-855-452-5323</td>
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<td>Mississippi</td>
<td>Mississippi Emergency Management Agency</td>
<td>1-800-222-6362</td>
</tr>
<tr>
<td>North Carolina</td>
<td>North Carolina Div. of Water Quality</td>
<td>1-800-858-0368</td>
</tr>
<tr>
<td>South Carolina</td>
<td>South Carolina DHEC</td>
<td>1-888-481-0125</td>
</tr>
<tr>
<td>Tennessee</td>
<td>Tennessee Wildlife Resources Agency</td>
<td>Region 1, West Tennessee: 1-800-372-3928</td>
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<td>Region 2, Middle Tennessee: 1-800-624-7406</td>
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<td>Region 3, Cumberland Plateau: 1-800-262-6704</td>
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<td>Region 4, East Tennessee: 1-800-332-0900</td>
</tr>
<tr>
<td>Virginia</td>
<td>Virginia Emergency Operations Center</td>
<td>1-804-674-2400</td>
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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 a 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 EPA Worker Protection Standard (WPS) requires applicators to wear the label required PPE and 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 pesticides and general use pesticides used in agricultural plant production.
Pesticide Liability and Stewardship (cont’d)

**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 2 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 Preparedness:** 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 MSDSs away from the area where pesticides are stored. Provide copies of product MSDSs to your community first responders. Consult your local Extension Service 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 service for assistance.
General Pesticide Information

Mode of Action (MOA): Pesticides affect target pests 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.

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, 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.

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

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 the pesticide MOA between treatments.
General Pesticide Information (cont’d)

**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 Extension agent or an appropriate state Extension specialist.

<table>
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<tr>
<td>Agrian Label Database</td>
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<tr>
<td>Crop Data Management Systems</td>
<td><a href="https://www.cdms.net/Label-Database">https://www.cdms.net/Label-Database</a></td>
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<td>Greenbook Data Solutions</td>
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<tr>
<td>Kelly Registration Systems¹</td>
<td><a href="https://www.kelly-products.com/">https://www.kelly-products.com/</a></td>
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<tr>
<td>National Pesticide Information Retrieval System²</td>
<td><a href="https://www.npirs.org/state/">https://www.npirs.org/state/</a></td>
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¹Available for AL, FL, GA, MS, NC, SC, and VA in the southeastern U.S.
²Available for AL, AR, FL, KY, LA, TX, and VA 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 or importance of a management option is indicated by E = excellent, VG = very good, G = good, F = fair, P = poor, NC = no control, and ND = no data. These ratings are benchmarks; actual performance will vary. A superscript ‘R’ (⁺) next to the efficacy rating indicates that the product may not be effective if the pathogen is resistant to the fungicide.
Pollinator Protection

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

1. Use selective pesticides to reduce risk to pollinators and other non-target beneficial insects. Visit the Commonly Used Pesticides Grouped According to Their Relative Hazards to Honey Bees table in the Georgia Pest Management Handbook for specific pesticide hazard levels.

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. Consider mowing ground cover if plants are flowering prior to pesticide application.

4. Follow 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.
Considerations for Sprayer Equipment 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 (smallfruits.org).
Mobile and Online Tools

**MyIPM App**

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

![MyIPM App Image]

**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.

**Strawberry Diagnostic Key**

A diagnostic tool available at https://diagnosis.ces.ncsu.edu/strawberry/ that includes information on insects, diseases, nutritional deficiencies, and physiological disorders.

**Strawberry Advisory System**

A weather-based decision support system available at https://ipm.ces.ncsu.edu/strawberry-fruit-infection-risk-tool/ that predicts fruit infection risk in North Carolina to help optimize spray timing for Botrytis grey mold and anthracnose fruit rots.

![Strawberry Advisory System Image]
Disease Alert: Neopestalotiopsis Fruit Rot and Leaf Spot

Neopestalotiopsis fruit rot and leaf spot, caused by a *Neopestalotiopsis* sp., was reported to cause damage in strawberry fields in Florida in 2019 and 2020 (Baggio et al., 2020). This disease has since been observed in multiple southeastern states. Growers should be diligent and on the lookout for unusually severe leaf spotting/scorching symptoms. Natalia Peres (University of Florida – IFAS) published an article about this disease and its management – or lack thereof. “Below-ground symptoms were characterized by darkening of the roots and orange-brown necrosis in the crowns, which contributed to stunting or poor establishment after transplanting. Above-ground symptoms ranged from stunting to wilting and necrosis of older leaves, to eventual collapse and death of the entire plant.” There has been a strong association with long periods of rainfall and spidermitic infestations. Whole-plant symptoms can be similar to those of Phytophthora root rot or anthracnose crown rot. Fruit rot symptoms are similar to those of anthracnose, whereas leaf spot symptoms mimic other common leaf spots on strawberry caused by *Phomopsis* or *Gnomonia*; therefore, microscopic examination of spores is likely required for confirmation. Be extra vigilant when purchasing, receiving, and inspecting strawberry plants; make sure that your nursery source does not have a history of this disease. Work with county agents and local Extension specialists and diagnostic labs to confirm diseases that are showing up on young and maturing plants as the season progresses. To date, Switch and thiram products are the only fungicides that provide suppression of this disease (~50% control) against fruit rot. There is a Section 2(ee) Recommendation in some states for Thiram SC and Switch 62.5 WG for Neopestalotiopsis. Check with local Extension specialists as additional products may receive Section 2(ee) Recommendations for Neopestalotiopsis in the future.

Additional information and photos of this disease are available in the Vegetable Berry Times March 2019 newsletter and the Vegetable Berry Times 2020 Issue 1 newsletter by the University of Florida IFAS, both available at [https://grec.ifas.ufl.edu/publications-and-newsletters/berry-vegetable-times-archives/](https://grec.ifas.ufl.edu/publications-and-newsletters/berry-vegetable-times-archives/), and in the University of Florida IFAS publication “Pestalotia Leaf Spot and Fruit Rot of Strawberry” available at [https://edis.ifas.ufl.edu/pp357](https://edis.ifas.ufl.edu/pp357).

Insect Alert: Spotted Lanternfly

A new insect pest, spotted lanternfly (SLF, *Lycorma delicatula* (White)), has entered the Southeastern region. This insect is spreading through Virginia and, as of September 2022, has been found in two counties in North Carolina. SLF is in the planthopper family, and all stages are active jumpers. SLF has a broad host range. While grape is by far the most vulnerable crop, SLF feeds on more than 70 species of plants, including strawberries. Early SLF (nymphal stages) instars are black with white spots and are the stage most likely to be found on strawberry. Fourth instar nymphs are bright red with black and white markings. Adults have pinkish grey front wings with black spots. The pink cast is due to the bright red hind wings showing through the front wings. Evidence of SLF feeding includes the accumulation of honeydew on leaf surfaces, which supports the growth of the fungus that causes sooty mold. Economic significance of SLF is currently being examined. Nymphs can be controlled by many insecticides that are used for other early-season strawberry pests, e.g., bifenthrin, fenpropathrin, and carbaryl. In crops where adults are the main problem (late season), continued re-immigration is a significant problem. However, this is less likely to be the case if nymphs are found feeding on strawberry. Risk may be higher if plantings are near stands of tree-of-heaven, a key host tree.


![Spotted lanternfly early instar nymph (A), fourth instar nymph (B), and adults (C). Photos: Doug Pfeiffer, Virginia Tech.](image)
<table>
<thead>
<tr>
<th>Developmental Stage</th>
<th>Planting and Early Post-planting</th>
<th>New Leaf Growth to Pre-bloom</th>
<th>Early Bloom (10%) and into Harvest</th>
</tr>
</thead>
</table>
| **Diseases potentially present (Fungicides)** | **Note: Pre-plant fumigation is required for management of black root rot** (see “Fumigants.”) | Bortyris crown rot<sup>2</sup>:  
   1. Rovral (2)  
   2. captan (M04)  
   3. thiram (M03) | Botrytis fruit rot<sup>2</sup>:  
   1. Fontelis, Kenja (7)  
   2. Luna Tranquility<sup>3</sup> (7 + 9)  
   3. Luna Sensation (7 + 11)  
   4. Switch (9 + 12)  
   5. Elevate (17)  
   6. Miravis Prime (7 + 12)  
   7. thiram (M03)  
   8. captan (M04)  
   9. Scala (9)  
  10. polyoxin D zinc salt (19) |
| | Pre-plant dips are recommended for anthracnose, Rhizoctonia, and Phytophthora crown/root rots (see “Pre-plant Dips”). | Common leaf spot, leaf scorch, leaf blight: (myclobutanil, captan, captan + thiophanate-methyl)  
   Powdery mildew (Procure, Rally, Rhyme, Quintec, Torino, Gatten, propiconazole)  
   Angular leaf spot (copper, Actigard)  
   Red stele; Phytophthora crown/root rots (mefenoxam, Orondis Gold, phosphites, fosetyl-Al)  
   Rhizoctonia sp. (seedling root rot and basal stem rot (azoxystrobin)  
   Charcoal rot (Rhyme)  
   Powdery mildew (Procure, Rally, Rhyme, Quintec, Gatten, sulfur)  
   Anthracnose fruit rot and/or crown rot<sup>2</sup>:  
   - Inspect plants on arrival, and scout after establishment.  
   - Captan and thiram are recommended for disease prevention. **IF** anthracnose comes in with transplants and is confirmed, see “Early Bloom (10%) and into Harvest” recommendations for more fungicide options. | Anthracnose fruit rot<sup>2</sup>:  
   1. Pristine, Merivon, Luna Sensation (11 + 7)  
   2. Cabrio, azoxystrobin, Flint Extra (11)  
   3. Quadris Top, Quilt Xcel (11 + 3)  
   4. captan (M04)  
   5. Switch (9 + 12)  
   6. Miravis Prime (7 + 12)  
   7. propiconazole (3)  
   Anthracnose crown rot<sup>2</sup>:  
   1. captan (M04)  
   2. thiophanate-methyl (1)  
   3. Quadris Top (11 + 3)  
   4. Protocol (1 + 3)  
   5. Miravis Prime (7 + 12)  
   Powdery mildew (Procure, Rally, Rhyme, Quintec, Torino, Gatten)  
   Common leaf spot, leaf scorch, leaf blight: (myclobutanil, captan, captan + thiophanate-methyl) |
| | Red stele; Phytophthora crown/root rots (mefenoxam, Orondis Gold, phosphites, fosetyl-Al)  
   **Rhizoctonia** sp. (seedling root rot and basal stem rot (azoxystrobin)  
   **Charcoal** rot (Rhyme)  
   Powdery mildew (Procure, Rally, Rhyme, Quintec, Torino, Gatten, sulfur)  
   Anthracnose fruit rot and/or crown rot<sup>2</sup>:  
   - Scouting plants after establishment is recommended.  
   - Captan and thiram are recommended for disease prevention. **IF** anthracnose is confirmed, see “Early Bloom (10%) and into Harvest” recommendations for more fungicide options.  
   - **Anthracnose** fruit rot and/or crown rot<sup>2</sup>:  
   Red stele; Phytophthora crown/root rots (mefenoxam, metalaxyl, phosphites, fosetyl-Al) | Anthracnose fruit rot<sup>2</sup>:  
   1. Pristine, Merivon, Luna Sensation (11 + 7)  
   2. Cabrio, azoxystrobin, Flint Extra (11)  
   3. Quadris Top, Quilt Xcel (11 + 3)  
   4. captan (M04)  
   5. Switch (9 + 12)  
   6. Miravis Prime (7 + 12)  
   7. propiconazole (3)  
   Anthracnose crown rot<sup>2</sup>:  
   1. captan (M04)  
   2. thiophanate-methyl (1)  
   3. Quadris Top (11 + 3)  
   4. Protocol (1 + 3)  
   5. Miravis Prime (7 + 12)  
   Powdery mildew (Procure, Rally, Rhyme, Quintec, Torino, Gatten)  
   Common leaf spot, leaf scorch, leaf blight: (myclobutanil, captan, captan + thiophanate-methyl) |

<sup>1</sup> FRAC codes identifying the product MOA are listed in parentheses for all products listed for anthracnose and Botrytis diseases. Active ingredient (a.i.) names, rather than trade names, are provided when multiple trade name products with the a.i. are available.

<sup>2</sup> See **RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43**.

<sup>3</sup> Luna Tranquility is not registered for use in Louisiana.
### Seasonal “At-a-Glance” Arthropod Guide

<table>
<thead>
<tr>
<th>Developmental Stage</th>
<th>Post-planting (Fall/early to mid-winter)</th>
<th>Pre-harvest — Bloom (Late winter to early spring)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pests potentially present (Insecticides/Miticides)</td>
<td>Crickets (carbaryl, malathion)</td>
<td>Aphids⁴ (malathion, Sivanto, imidacloprid, Platinum, insecticidal soap)</td>
</tr>
<tr>
<td></td>
<td>Cutworms (carbaryl, Coragen, Entrust, malathion, <em>Br</em>, Intrepid)</td>
<td>Fire ants² (Extinguish Professional Fire Ant Bait, Esteem Ant Bait)</td>
</tr>
<tr>
<td></td>
<td>Cyclamen mites (Portal, abamectin)</td>
<td>Fire ants² (Extinguish Professional Fire Ant Bait, Esteem Ant Bait)</td>
</tr>
<tr>
<td></td>
<td>Fire ants² (Extinguish Professional Fire Ant Bait, Esteem Ant Bait)</td>
<td>Flower thrips⁴ (Entrust, Radiant, minute pirate bugs)</td>
</tr>
<tr>
<td></td>
<td>Twospotted spider mites:³</td>
<td>Slugs/snails (baits containing carbaryl, metaldehyde, or iron phosphate)</td>
</tr>
<tr>
<td></td>
<td>1. Acramite/Vigilant, Kanemite, Nealta (all stages)</td>
<td>Strawberry clippers⁴ (bifenthrin, Danitol, carbaryl)</td>
</tr>
<tr>
<td></td>
<td>2. Oberon, Savey, Zeal (eggs and juveniles)</td>
<td>Twospotted spider mites⁵: See “Post-planting” column</td>
</tr>
<tr>
<td></td>
<td>3. Portal, Agri-Mek, Vendex (juveniles and adults)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. M-Pede, horticultural oils (all stages; OMRI-listed)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Predatory mites</td>
<td></td>
</tr>
<tr>
<td>Harvest</td>
<td>Fire ants² (Extinguish Professional Fire Ant Bait, Esteem Ant Bait)</td>
<td>Sap beetles⁶ (cultural control, Rimon)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slugs/snails (baits containing carbaryl, metaldehyde, or iron phosphate)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spotted-wing drosophila (bifenthrin, Danitol, Entrust, Malathion and generics, Radiant)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tarnished plant bugs⁷ (bifenthrin, Danitol, Rimon)</td>
</tr>
</tbody>
</table>

---

¹ Management of strawberry arthropod pests is based on pest presence in the field. There is no preventive spray program, and listed materials only work if target pests are present! **Treat only if damaging populations are present.** Thorough regular scouting is necessary to detect pests early before infestations build to damaging levels.

² Fire ant baits work slower than contact materials but provide longer term management by sterilizing the queen and preventing larvae from developing over a 4- to 8-week period. Apply baits as soon as ant foraging is noted in the spring. Ants must be actively foraging for baits to be effective.

³ A thorough inspection of planting material is necessary to avoid introducing mites from the nursery into production fields. Scouting to determine the extent of infestation and the presence of eggs is necessary. Materials in the first group have efficacy against all stages of spider mites. The second group is effective against eggs and juvenile life stages of the twospotted spider mite. The third group of materials has efficacy against all motile (or moving, non-egg stages). Materials in groups 1 and 2 are the primary tools for spring infestations. Fall use could affect the number of applications allowed in the spring. The third group of materials is organically acceptable (OMRI-listed) and effective only against adults; coverage is very important to the efficacy of these materials. Resistance management is crucial for all miticides. Rotate to an insecticide from a different new mode of action (MOA) (IRAC group) if more than one treatment is necessary (see tables for IRAC groups). Follow resistance management guidelines on labels. Native predatory mites may be effective. They may be augmented with mites from commercial sources. Carbaryl, pyrethroids, and neonicotinoids are highly toxic to predatory mites.

⁴ Aphid, flower thrips, and strawberry clipper populations have to be very high to cause yield loss in strawberry. Spraying insecticides during bloom is hazardous to honey bees; follow instructions on pesticide labels to minimize damage to honey bees.

⁵ As weather begins to warm, scout regularly for mites. Follow label instructions about resistance management carefully when using miticides.

⁶ Sap beetles are attracted to overripe fruit. Keeping fruit picked and removed from the field will reduce problems with sap beetles.

⁷ Tarnished plant bugs can feed early in the spring on flowers and developing weed seeds. Wild radish, often called wild mustard, is a favored late winter host. Reducing weeds in and around fields will reduce populations. See note above about honey bees.
# Pre-planting: Disease, Nematode, and Weed Management

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Activity</th>
<th>Effectiveness*</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracnose</td>
<td>Use disease-free plants</td>
<td>Importance: E Efficacy: E</td>
<td>Use of certified plants or plants produced in a similarly stringent program is the most important method to prevent these diseases. Inspect plants thoroughly for disease symptoms, particularly lesions on stems and leaves.</td>
</tr>
<tr>
<td>Angular leaf spot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phytophthora crown rot</td>
<td>Site selection, preparation, and water</td>
<td>Importance: E Efficacy: E</td>
<td>Phytophthora crown rot can be particularly problematic in low areas that drain poorly. Choose a planting site that has good drainage and/or take measures to improve drainage (e.g., drain tile). Also, do not overwater in order to reduce conditions favorable for Phytophthora crown rot.</td>
</tr>
<tr>
<td>Fusarium wilt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viruses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botrytis (gray mold)</td>
<td>Remove flowers and dead tissue present on</td>
<td>Importance: ND Efficacy: ND</td>
<td>This practice may help to reduce Botrytis.</td>
</tr>
<tr>
<td>transplants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nematodes</td>
<td>Sample soil for nematode analysis</td>
<td>Importance: G</td>
<td>Sample soils for nematode analysis through local state services. Analysis results can help determine the best fumigant or IPM management plan to use.</td>
</tr>
<tr>
<td>Nematodes</td>
<td>Practice crop rotation</td>
<td>Importance: G Efficacy: G</td>
<td>Rotating fields with non-host crops for 2 to 3 years can suppress nematode populations and reduce black root rot and other disease problems.</td>
</tr>
<tr>
<td>Soilborne pathogens (Pythium, Phytophthora, Fusarium, Rhizoctonia)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeds</td>
<td>Pre-plant fumigation and laying down plastic</td>
<td>Efficacy: E</td>
<td>See <a href="#">fumigation table</a> below. Consult with custom applicators and/or Extension agents for product and rate recommendations.</td>
</tr>
<tr>
<td>Root and crown rot disorders (black root rot; Phytophthora crown rot)</td>
<td></td>
<td></td>
<td>Cultivars with various levels of resistance to anthracnose fruit rot have been identified (see <a href="#">Cultivar Resistance to Anthracnose table</a> below); however, cultivar performance against this disease varies depending on location. Growers interested in trying these cultivars are STRONGLY advised to test a small number of plants of the desired cultivar(s) to determine performance before heavily investing in a specific cultivar to place into significant production.</td>
</tr>
<tr>
<td>Nematodes</td>
<td>Use resistant varieties</td>
<td>Importance: E Efficacy: G</td>
<td>Cultivars with various levels of resistance to anthracnose fruit rot have been identified (see <a href="#">Cultivar Resistance to Anthracnose table</a> below); however, cultivar performance against this disease varies depending on location. Growers interested in trying these cultivars are STRONGLY advised to test a small number of plants of the desired cultivar(s) to determine performance before heavily investing in a specific cultivar to place into significant production.</td>
</tr>
<tr>
<td>Nutrient deficiencies</td>
<td>Sample soil for nutrient analysis</td>
<td>Importance: E Efficacy: E</td>
<td>Sample soils for nutrient profiles through local state services. Analysis results can help determine the best fertilizer program and necessary adjustments for soil pH. Proper fertilization impacts plant health.</td>
</tr>
<tr>
<td>Nematodes</td>
<td>Use of anaerobic soil disinfection (ASD)</td>
<td>Efficacy: F - E</td>
<td>ASD is a potential alternative to soil fumigation. However, practical methods to employ this technique on-farm are still being researched. Growers interested in testing ASD on a small scale should read more about this technique (see <a href="#">Anaerobic Soil Disinfection</a> below) and contact their local county Extension service for guidance.</td>
</tr>
<tr>
<td>Soilborne plant pathogens</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeds (grasses, broadleaf weeds, yellow and purple nutsedge)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Pre-planting: Disease, Nematode, and Weed Management**

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Activity</th>
<th>Effectiveness*</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nematodes</td>
<td>Plant brassicaceous cover crops or incorporate mustard seed meal into soil</td>
<td>Efficacy: F - G</td>
<td>Cover cropping with brassicaceous crops or soil incorporation with mustard seed meal may help reduce stunting and yield losses from some plant-parasitic nematodes and root diseases such as black root rot. Growers interested in implementing these techniques should read more about these techniques (see Cover Cropping and Soil Incorporation Techniques below) and should contact their local county Extension service for guidance.</td>
</tr>
<tr>
<td>Nematodes</td>
<td>Solarization</td>
<td>Efficacy: ND</td>
<td>Solarization is a potential alternative to soil fumigation but does not provide the same level of effectiveness. When used in combination with techniques such as ASD, greater efficacy may be observed. Growers interested in implementing these techniques should read more about these techniques (see Soil Solarization below) and should contact their local county Extension service for guidance.</td>
</tr>
<tr>
<td>Viruses</td>
<td>Begin with virus-free plants</td>
<td>Efficacy: E</td>
<td>Invest in quality plants from reputable nurseries that practice vector exclusion and disease management strategies and that screen for viruses. Read more about strawberry viruses and their management in Viruses in Strawberries below.</td>
</tr>
</tbody>
</table>

*Efficacy/Importance ratings: E = excellent, VG = very good, G = good, F = fair, P = poor, NC = no control, and ND = no data.

**Cultivar Resistance to Anthracnose**

Most commercial strawberry cultivars, such as Chandler and Camerosa, do not have resistance to anthracnose. Over the years, researchers in various locations have tested a number of strawberry cultivars for resistance to anthracnose fruit rot. Cultivars with various levels of resistance have been identified (see table); however, results have varied depending on location. The table to the right lists cultivars that were shown to have medium resistance (MR) or to be resistant (R) in at least one of the reviewed trials and the southeastern states where these cultivars are known to be grown on some acreage. **It is not currently known if these varieties are suitable for production in southeastern states.**

Due to observed differences in performance, it is STRONGLY advised that growers interested in these cultivars test a small number of plants of the desired cultivar(s) to determine performance before heavily investing in a specific cultivar to place into significant production.

<table>
<thead>
<tr>
<th>Resistant</th>
<th>Medium Resistance to Resistant</th>
<th>Medium Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavorfest</td>
<td>Dover</td>
<td>Carmine</td>
</tr>
<tr>
<td>Florida Belle</td>
<td>Florida Radiance</td>
<td>Florida Brilliance</td>
</tr>
<tr>
<td>Florida Elyana</td>
<td>Pelican</td>
<td>Ovation</td>
</tr>
<tr>
<td>Pelican</td>
<td>Prado</td>
<td>Rubygem</td>
</tr>
<tr>
<td>Prado</td>
<td>Sweet Sensation</td>
<td>Sweet Charlie</td>
</tr>
<tr>
<td>Sweet SensationED</td>
<td>Winterstar</td>
<td></td>
</tr>
<tr>
<td>Winter DawnFR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ED = soft and easily damaged by rain
FR = freeze risk due to early flowering

States in which cultivars are known to be grown on some acreage: AR = Arkansas, GA = Georgia, KY = Kentucky, LA = Louisiana, MS = Mississippi, NC = North Carolina, SC = South Carolina, TN = Tennessee, VA = Virginia. *(This is not a comprehensive list for all southeastern states.)*
Anaerobic Soil Disinfestation

Anaerobic soil disinfestation (ASD) is a potential alternative to traditional fumigants. However, practical methods to employ ASD on-farm are still being researched. **Growers interested in testing this technique on a small scale should contact their local county Extension service for guidance.** ASD involves incorporating very high volumes of a carbon source material into soil when beds are formed and plastic mulch is laid (**at least** 30 days before transplanting), saturating the soil for the duration of treatment (~21 days), and then aerating the soil by punching planting holes 10 to 14 days prior to transplanting. Suitable carbon sources may vary by region and are still being identified. Nitrogen fertilizer application in beds may need adjustment depending on the carbon source material used. Additional information and resources on ASD are available in the publication “Anaerobic Soil Disinfestation for the Mid-Atlantic Region.” **Note:** While ASD is technically a pre-plant treatment, treatments are implemented earlier than most pre-plant treatments; planning should begin 6 to 7 weeks before transplanting for implementation by late July/early August.

Cover Cropping and Soil Incorporation Techniques

Planting 1-2 cycles of a brassicaceous cover crop (‘Caliente’ mustard, for example) before transplanting strawberry may help reduce stunting and yield loss from plant-parasitic nematodes and root diseases such as black root rot. However, treatment efficacy depends upon methods, particularly cover crop biomass, timing and extent of cover crop destruction and incorporation, and soil moisture at incorporation. Mustard seed meals incorporated into beds at least 21 days before transplanting have also reduced black root rot. Multiple years of research suggest banded rates of 1,000-2,000 lb/A are needed. Additional information on the use of cover crops is available in the publication “Sustainable Practices for Plasticulture Strawberry Production in the South.” **Growers interested in implementing these techniques should contact their local county Extension service for guidance.** **Note:** While use of cover crops and soil incorporation with mustard seed meal are technically pre-plant treatments, treatments are implemented earlier than most pre-plant treatments; planning should begin 6 to 7 weeks before transplanting for implementation by late July/early August.

Soil Solarization

Soil solarization is a passive process that uses heat and moisture to kill or inactivate certain pests, including some nematodes, soilborne plant pathogens, and annual weeds, present in the soil, and thereby reduce or eliminate the incidence or occurrence of those pests in the succeeding growing season. Soil solarization involves covering moistened soil with clear polyethylene (plastic) 1 to 1.25 mils thick for a period of 6 to 8 weeks. The edges of the plastic should be covered with soil and/or weighed down to trap moisture and heat. Soil moisture should be maintained at 70% field capacity during solarization using drip irrigation. The goal of this process is to raise the soil temperature under the plastic to levels much higher than the ambient air temperature for an extended period of time, while providing adequate moisture, to expose target pests to conditions that cause inactivity or death. Due to the length of time required for the solarization process, implementation should begin 7 to 9 weeks (typically late July/early August) before transplanting. Growers may choose to use the clear plastic as mulch for their strawberry beds but should keep in mind that soil temperatures using the clear plastic may be lower during the winter relative to black plastic mulch. Additional information on soil solarization and challenges associated with this treatment can be found in the publication “Introduction to Soil Solarization.” **Growers interested in testing this technique on a small scale should contact their local county Extension service for guidance.**
Viruses in Strawberries

A number of viruses are capable of infecting strawberries; when these viruses accumulate in plants, they could cause significant yield losses. Viruses have not commonly been problematic in strawberry production in the Southeastern U.S. However, aphid- and whitefly-transmitted viruses can become a problem, primarily in multi-year fields as viruses tend to accumulate over time. This is increasingly important with the recent discovery of multiple new viruses that are transmitted by these vectors (Medberry and Tzanetakis, 2022; Medberry, et al., 2022). The most common viruses in the Southeast are beet pseudo-yellows virus (BPYV), strawberry crinkle virus (SCV), strawberry mild yellow edge virus (SMYEV), strawberry mottle virus (SMoV), strawberry necrotic shock virus (SNSV), strawberry pallidosis associated virus (SPaV), and strawberry vein-banding virus (SVBV); of these, BPYV, SPaV, and SMoV are the most prevalent (Martin and Tzanetakis, 2013). In addition, the movement of non-certified planting material across states and counties increases the potential for virus epidemics to occur.

Viruses are not typically problematic in strawberries produced in an annual system when beginning with virus-tested planting stock. In the past 20 years, all strawberry virus epidemics started from second-year fields or nursery stock. Multi-year fields are almost guaranteed to harbor virus-infected plants. Growers who opt for a multi-year production cycle need to monitor for virus vectors—primarily aphids and whiteflies—and manage them to avoid establishment in the field.

Management of viruses in annual strawberry production and production nurseries can largely be accomplished through exclusion and vector management.

In annual field production:
- **Always begin with virus-tested planting stock.** Planting stock is the most important part of the production scheme. If planting stock is tested for viruses, even if plants become infected in the field, effects in yield are typically minimal as there is not enough time for symptoms to develop. The exception would be if plants become infected very early in the season.
- **Invest in quality plants from reputable nurseries** that practice vector exclusion and disease management strategies and that screen for viruses. A little research up front can save a lot of money in the end.

In production nurseries:
- Nurseries are encouraged to follow standards regarding production, virus detection and testing, and vector management in nurseries. Visit the National Clean Plant Network (NCPN) - Berries website at [www.ncpnberries.org](http://www.ncpnberries.org) for more information.
- **Inspect, sample, and test planting fields for target viruses.** Visit [www.ncpnberries.org](http://www.ncpnberries.org) for suggested inspection times, sampling protocols, and certifying agencies.
- **Follow best management practices that target virus vectors,** particularly strawberry aphids and the greenhouse whitefly, to help reduce the chance of infection. Visit [www.ncpnberries.org](http://www.ncpnberries.org) for specific management practices relevant to various production materials and practices.

Pre-plant Dips

Several products are registered as plant dips to manage pathogens or to protect plants just prior to field setting, but only a limited amount of research has been done with plant dips. In general, these treatments are not recommended except under specific circumstances, for example, if a disease has been diagnosed to be on the transplants. Products not labeled for dip treatments should not be used for dips, since poor plant performance has been observed in research trials.

**Abound (FRAC 11)** — Mix 5 to 8 fl oz/100 gal of water. Dip plants for 2 to 5 min. Transplant treated plants as quickly as possible. This treatment has been developed for bare root transplants with a known problem of anthracnose. The dip is a whole plant dip, and some growers do not re-use the water for fear of spreading angular (bacterial) leaf spot and other diseases. It is reasonable to expect these fungicides to have some *Rhizoctonia* suppressive activity, but there are no research results to demonstrate a benefit. For managing *Rhizoctonia*, a root dip should suffice, rather than dipping whole plants. *Rhizoctonia* (and the black root rot problem) builds up over time; it is doubtful that a root dip would offer much benefit for season long control. Growers must ensure root dip waste is properly disposed.

**Switch 62.5WG (FRAC 9 + 12)** — Switch offers options for treating plants known to be infected with *Colletotrichum* species (anthracnose) and has shown good efficacy in reducing losses due to the crown rot pathogen in bare root transplants (*Colletotrichum gloeosporioides*). Use 5 to 8 fl oz/100 gal water. Wash transplants to remove excess soil prior to dipping. Completely immerse planting stock in dip solution. Dip or expose plants for a minimum of 2 to 5 min. Do not reuse solution. Growers must ensure proper disposal of root dip waste. Plant treated plants as quickly as possible. Delayed planting could cause plant stunting.

**Zivion S (FRAC 48)** is a liquid formulation of natamycin to control anthracnose (*Colletotrichum* spp.), Verticillium wilt, and charcoal rot (*Macrophrina phasiolina*). The active ingredient is derived from the bacterium *Streptomyces natalensis* and produced by microbial fermentation. **Zivion may not be registered for use in all states. Check state registration prior to use.** Apply as root or whole plant dip treatment prior to planting. Mix 6-12 fl oz (0.04-0.08 lb natamycin) of Zivion S per 10 gal of water. Dip plants for a minimum of 2 min, but no more than 5 min. Plant treated plants after dip application. Transplants should be washed to remove excess soil prior to dipping.

**Phosphites/fosetyl-Al (FRAC P07, formerly FRAC 33)** — Dip plants in 2.5 lb/100 gal (Aliette WDG), 2 pt/100 gal (ProPhyt), or 2.5–5.0 pt/100 gal (Phostrol) for 15 to 30 min and then plant within 24 hr after treatment. This treatment should help to suppress *Pythium* and *Phytophthora* problems.

Little data are available for other plant dip products, including OxiDate, and it is doubtful that they offer management of root diseases. In most cases, root pathogens are internal to the tissue and are not controlled by surface disinfectants.
### Pre-planting and Early Post-planting: Nematode Management

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness</th>
<th>REI</th>
<th>PHI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nematodes (root-knot, lesion, sting, and foliar)</td>
<td>heat-killed <em>Burkholderia</em> spp. strain A396 (Majestene)</td>
<td>4 to 8 qt</td>
<td>See comments</td>
<td>4 hr</td>
<td>0 days</td>
<td>Majestene is a biological nematicide approved for organic strawberry production. It has not been extensively field-tested on strawberry in the Southeast and Mid-Atlantic states, but research to date suggests useful activity against major plant-parasitic nematodes. Apply via drip or incorporated spray. Can be applied prior to planting, at planting or shortly thereafter, and again later in the season. Higher rates are likely more effective, and repeated applications also increase the extent and duration of nematode control. If nematode populations are high, it should be combined with other products. <strong>OMRI-listed.</strong></td>
</tr>
<tr>
<td>fluensulfone (Nimitz)</td>
<td>3.5 to 7 pt/ treated A</td>
<td>See comments</td>
<td>12 hr</td>
<td>0 days</td>
<td>Nimitz is a selective nematicide. It has not been extensively tested on strawberry in the Southeast and Mid-Atlantic states, but research on other crops in these areas and on strawberry elsewhere suggests moderate to good activity – not quite as effective as soil fumigant standards – against most major plant-parasitic nematode species. Apply via drip or incorporated spray at least 7 days before planting. Soil temperature must be 60 °F or above. Soil incorporation in the top 6–8 in. is critical. Irrigating (0.5–1 in.) 2–5 days after application is recommended. Do not apply more than 1 application per crop. Do not apply more than 3.5 lb fluensulfone per acre per calendar year.</td>
<td></td>
</tr>
<tr>
<td>Pest/Problem</td>
<td>Management Options</td>
<td>Amount of Formulation per Acre</td>
<td>Effectiveness</td>
<td>REI</td>
<td>PHI</td>
<td>Comments</td>
</tr>
<tr>
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</tr>
<tr>
<td>Nematodes (root-knot, lesion, sting, and foliar) (cont’d)</td>
<td>fluopyram (Velum Prime)</td>
<td>6 to 6.8 fl oz</td>
<td>See comments</td>
<td>12 hr</td>
<td>0 days</td>
<td>Fluopyram has fungicideal and nematicidal activity. Velum Prime has not been extensively tested on strawberry in the Southeast and Mid-Atlantic states, but research on other crops in these areas and on strawberry elsewhere suggests moderate to good activity. Apply via drip or incorporated spray. Can be applied prior to planting, at planting or shortly thereafter, and again later in the season. However, do not apply more than 13.7 fl oz of product per acre per year. Do not apply more than 0.446 lb of fluopyram per acre per year regardless of formulation or method of application. Note: Luna Sensation and Luna Tranquility are also fluopyram products used as fungicides. <strong>FRAC 7.</strong></td>
</tr>
<tr>
<td>Purpureocillium lilicanus (Melocon LC)</td>
<td>10.25 fl oz</td>
<td>See comments</td>
<td>See label</td>
<td>0 days</td>
<td>Melocon is a biological nematicide approved for organic strawberry production. It has not been extensively field-tested on strawberry in the Southeast and Mid-Atlantic states, but research to date suggests useful activity against major plant-parasitic nematodes. Apply via drip or drench. Can be applied prior to planting, at planting or shortly thereafter, and again later in the season. Repeated applications increase the extent and duration of nematode control. If nematode populations are high, it should be combined with other products. <strong>OMRI-listed.</strong></td>
<td></td>
</tr>
</tbody>
</table>
Fumigants

New fumigant labels require extensive risk mitigation measures including fumigant management plans (FMPs), buffer restrictions, worker protection safety standards, and other measures. Details are on the labels and at https://www.epa.gov/soil-fumigants. Some fumigants are registered for use on multiple crops but with crop- or soil-type-specific rates; others are registered for use on specific crops and/or in certain states only. Not all products are registered for use in all states. Follow all labels carefully.

<table>
<thead>
<tr>
<th>Product</th>
<th>Rate per Treated Acre</th>
<th>Nematodes</th>
<th>Disease</th>
<th>Nutsedge</th>
<th>Weeds: Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pic-Clor 60 (chloropicrin + 1,3-dichloropropene)</td>
<td>48.6</td>
<td>E</td>
<td>E</td>
<td>P</td>
<td>G</td>
</tr>
<tr>
<td>Pic-Clor 60 EC&lt;sup&gt;4&lt;/sup&gt; (chloropicrin + 1,3-dichloropropene)</td>
<td>42.6</td>
<td>E</td>
<td>E</td>
<td>P</td>
<td>G</td>
</tr>
<tr>
<td>Pic-Clor 80 (chloropicrin + 1,3-dichloropropene)</td>
<td>34</td>
<td>G</td>
<td>E</td>
<td>P</td>
<td>F</td>
</tr>
<tr>
<td>InLine&lt;sup&gt;4&lt;/sup&gt;(1,3-dichloropropene + chloropicrin)</td>
<td>29 to 57.6</td>
<td>325 to 645</td>
<td>E</td>
<td>E</td>
<td>P</td>
</tr>
<tr>
<td>Telone C-35 (1,3-dichloropropene + chloropicrin)</td>
<td>39 to 50</td>
<td>437 to 560</td>
<td>E</td>
<td>E</td>
<td>P</td>
</tr>
<tr>
<td>chloropicrin&lt;sup&gt;5&lt;/sup&gt;</td>
<td>see labels</td>
<td>see labels</td>
<td>VG</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>+ metam sodium&lt;sup&gt;5&lt;/sup&gt;</td>
<td>see labels</td>
<td>see labels</td>
<td>VG</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>chloropicrin&lt;sup&gt;5&lt;/sup&gt;</td>
<td>see labels</td>
<td>see labels</td>
<td>F</td>
<td>E</td>
<td>ND</td>
</tr>
<tr>
<td>Tri-Pic 100EC&lt;sup&gt;4&lt;/sup&gt; (chloropicrin)</td>
<td>8 to 24</td>
<td>100 to 300</td>
<td>F</td>
<td>E</td>
<td>ND</td>
</tr>
<tr>
<td>metam potassium&lt;sup&gt;5&lt;/sup&gt;</td>
<td>see labels</td>
<td>see labels</td>
<td>G</td>
<td>G</td>
<td>P</td>
</tr>
<tr>
<td>metam sodium&lt;sup&gt;5&lt;/sup&gt;</td>
<td>see labels</td>
<td>see labels</td>
<td>G</td>
<td>G</td>
<td>P</td>
</tr>
<tr>
<td>Dominus&lt;sup&gt;6&lt;/sup&gt; (allyl isothiocyanate)</td>
<td>25 to 40&lt;sup&gt;*&lt;/sup&gt;</td>
<td>212 to 340&lt;sup&gt;*&lt;/sup&gt;</td>
<td>F</td>
<td>G</td>
<td>P</td>
</tr>
<tr>
<td>Telone II (1,3-dichloropropene)</td>
<td>15 to 27</td>
<td>153 to 275</td>
<td>E</td>
<td>P</td>
<td>ND</td>
</tr>
<tr>
<td>Telone EC&lt;sup&gt;4&lt;/sup&gt; (1,3-dichloropropene)</td>
<td>9 to 24&lt;sup&gt;*&lt;/sup&gt;</td>
<td>91 to 242&lt;sup&gt;*&lt;/sup&gt;</td>
<td>E</td>
<td>P</td>
<td>ND</td>
</tr>
</tbody>
</table>

<sup>1</sup> Fumigants with lower efficacy against weeds may require a complementary herbicide or hand-weeding program, although use of virtually impermeable film (VIF) or totally impermeable film (TIF) may increase weed control, particularly with Telone C35. Refer to the Herbicide Recommendation section of this guide for directions pertaining to herbicide applications. Telone can persist more than 21 days under cool or wet soil conditions.

<sup>2</sup> Rates can sometimes be reduced if products are applied with VIF or TIF.

<sup>3</sup> Efficacy Ratings: The efficacy of a management option is indicated by E = excellent, VG = very good, G = good, F = fair, P = poor, and ND = no data. These ratings are benchmarks; actual performance will vary.

<sup>4</sup> Product is formulated for application through drip lines under a plastic mulch; efficacy is dependent on good distribution of the product in the bed profile.

<sup>5</sup> Metam potassium can be Metam KLR, K-Pam, Sectagon K54 or other registered formulations and should be used in soils with high sodium content. Metam sodium can be Vapam, Sectagon 42, Metam CLR or other registered formulations. Chloropicrin can be applied by itself (e.g., Pic100) but is usually applied as a mixture with 1,3-dichloropropene.

<sup>6</sup> Dominus is registered but there is limited experience with the product through university or independent trials in our region; growers may want to consider this on an experimental basis. Planting interval is 10 days. The active ingredient allyl isothiocyanate is similar to the active ingredient in metam sodium products (methyl isothiocyanate) and is likely to behave in a similar manner with a similar pest control profile.

<sup>*</sup> Labelled rates are per broadcast-equivalent acre, NOT per treated acre.
Fungicide Resistance Management Recommendations (See page 43 for more details)

*Botrytis cinerea* (Botrytis fruit rot (sometimes referred to as gray mold) and Botrytis crown rot) historically has a high potential to develop resistance, and recent data suggest a high percentage of strains are resistant to several important fungicides. Therefore, it is important to give these recommendations serious consideration:

1. Thiram (FRAC M03) and captan (M04) should serve as the backbone for a season-long spray program.
2. Limit the number of times at-risk fungicides, such as FRAC 3, 7, 11, and 12 fungicides, are applied in a single year.
3. Tank-mix a broad-spectrum fungicide such as captan or thiram with Topsin M (a benzimidazole fungicide, FRAC 1) since Topsin M no longer has Botrytis activity due to resistance but is helpful for several early season foliar diseases, if present.
4. Resistance profiles vary from farm-to-farm. Sample Botrytis fruit rot populations for their resistance profile through Clemson University; details on page 44.

It is currently suggested that the strobilurin (QoI) fungicides (FRAC 11; e.g., Abound, Cabrio, Merivon, Pristine, and Quadris Top) not be used to control Botrytis and other disease problems but be saved for use in controlling anthracnose fruit rot (AFR) when there is a high potential for disease pressure. Captan or thiram should help suppress anthracnose when utilized in Botrytis or other disease control applications, but the QoI fungicides are currently the most effective materials for control of anthracnose. Some of these QoI fungicides may have activity against multiple pathogens other than the anthracnose pathogens, but unless anthracnose occurs in conjunction with these other diseases of concern, it is suggested that the QoI fungicides not be used. With only 4–5 total applications of the QoI fungicides per crop, it is an imperative that they be utilized effectively. Also, resistance management is extremely important with the QoI fungicides; make sure to follow all resistance management guidelines. Recently, we have documented reduced activity with azoxystrobin (Abound) with certain strains of the AFR pathogen. Other strains appear to be resistant to all QoI fungicides. Cabrio, Merivon, or Pristine have offered better control of AFR in recent research efforts AND if the strains are not resistant to QoI fungicides.

Anthracnose crown rot (ACR) (*Colletotrichum gloeosporioides* species complex) — Most plantings are rarely at risk for ACR. Thus, fungicides may not be needed. In most cases, contaminated plant sources are identified before or soon after planting. Know your plant source. ACR primarily comes in with the transplants. If present, anthracnose on plants can cause petiole lesions (black sunken areas), stunting, and plant death. Fall fungicide applications will be required for *Colletotrichum* only if plant source problems are identified, usually appearing as symptomatic plants or assayed for quiescent infections. Research results show that QoIs are more effective against the fruit rot pathogen (*Colletotrichum acutatum* species complex) compared to the crown rot pathogen. Captan, Topsin M, or Switch are effective for controlling the crown rot pathogen. In general, it is BEST to save the QoI (FRAC 11) chemistry for spring applications and protect the fruit if anthracnose (‘*acutatum*’) is known to be present. Failure in management of some ‘*acutatum*’ populations has been observed due to resistance to the QoI fungicides (FRAC 11) (see above). See section on Pre-plant Dips for anthracnose. Note: In some geographic locations, *Colletotrichum acutatum* species complex has been found to cause ACR; this may have an effect on fungicide efficacy.

Powdery mildew — Monitor the field for the first signs of powdery mildew (leaf distortion and discoloration). Mildew in the fall does not appear to cause significant damage and may not reappear in the spring. Therefore, most growers will not need to spray for powdery mildew. However, fields have been observed in the fall with severe foliar disease incidence, and plant productivity may then be hampered, justifying control measures. Likewise, if powdery mildew pressure occurs in the spring and affects the fruit, the fruit will have a dull appearance and be unmarketable unless managed well. High tunnels favor powdery mildew development. QoIs, in general, and Protocol are registered and effective for powdery mildew but are not recommended when only powdery mildew is present to avoid fungicide resistance selection in the anthracnose and *Botrytis* pathogens.
### Planting and Early Post-planting: Disease Management

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness</th>
<th>REI</th>
<th>PHI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red stele; Phytophthora crown/root rots</td>
<td>mefenoxam (Ridomil Gold SL) (Ultra Flourish)</td>
<td>1 pt/A&lt;br&gt;2 pt/A</td>
<td>VG</td>
<td>See label</td>
<td>0 days&lt;br&gt;See label</td>
<td>0 days</td>
</tr>
<tr>
<td>oxathiapiprolin + mefenoxam (Orondis Gold)</td>
<td>20.0 – 62.0 fl oz/A</td>
<td>VG</td>
<td>See label</td>
<td>28 days</td>
<td>Product should be applied through drip application. Do not apply more than two sequential applications before switching to a product with a different mode of action. Do not apply more than 2 applications per year at the maximum rate. In new plantings, the first application should be made soon after planting and the second application should be made 30 days before the beginning or harvest or at fruit set. In established plantings, the first application should be made in the spring before first bloom and the second application should be made after harvest. See label for other restrictions and limits. FRAC 49 + 4.</td>
<td></td>
</tr>
<tr>
<td>phosphites (ProPhyt)&lt;br&gt;[other products available]</td>
<td>(foliar)&lt;br&gt;2 to 4 pt&lt;br&gt;2.5 to 5.0 pt</td>
<td>F</td>
<td>4 hr&lt;br&gt;See labels&lt;br&gt;See labels</td>
<td>See label&lt;br&gt;See labels</td>
<td>Listed rates are for foliar applications. See product labels for rates specified for use for dip applications. Phosphite-based chemicals are not as effective as Ridomil Gold. Consider phosphites if the pathogen is known to be resistant to mefenoxam or if root systems are poor AND foliage is healthy for chemical uptake. Do not apply more than 30 lb of Aliette WDG per acre per season. Check other product labels for season limits. Check the registration status of products prior to use. Not all products are registered for use in all states. FRAC P07.</td>
<td></td>
</tr>
<tr>
<td>fosetyl-Al (Aliette WDG)</td>
<td>(foliar)&lt;br&gt;2.5 to 5.0 lb</td>
<td>F</td>
<td>12 hr&lt;br&gt;See labels</td>
<td>12 hr&lt;br&gt;See labels</td>
<td>This is a drip irrigation application method. Can be considered especially for plug plants with poor root systems or plants placed into non-fumigated beds or beds with excess water in heavy soils. See label for specific rate applications and limits for banded and in-furrow applications based on row spacing. FRAC 11.</td>
<td></td>
</tr>
<tr>
<td>&lt;strong&gt;Rhizoctonia sp.&lt;/strong&gt; (seedling root rot, basal stem rot)</td>
<td>azoxystrobin (Abound)&lt;br&gt;[other products available]</td>
<td>0.40 to 0.80 fl oz/1,000 row feet</td>
<td>F</td>
<td>4 hr&lt;br&gt;See labels</td>
<td>0 days&lt;br&gt;See labels</td>
<td>This is a drip irrigation application method. Can be considered especially for plug plants with poor root systems or plants placed into non-fumigated beds or beds with excess water in heavy soils. See label for specific rate applications and limits for banded and in-furrow applications based on row spacing. FRAC 11.</td>
</tr>
</tbody>
</table>
### Planting and Early Post-planting: Disease Management

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
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<th>REI</th>
<th>PHI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charcoal rot</td>
<td>flutriafol (Rhyme)</td>
<td>7 fl oz</td>
<td>F</td>
<td>12 hr</td>
<td>0 days</td>
<td>Product is to be applied through drip irrigation. Do not apply more than 4 applications per year. Do not apply more than 28 fl oz of product per acre per year. <strong>FRAC 3.</strong></td>
</tr>
<tr>
<td>Powdery mildew only</td>
<td><strong>Powdery mildew</strong> is not a common problem at this time of year; it may come in on transplants but usually does not persist or present an economic problem in open fields. There is a greater risk of powdery mildew in high tunnels. FRAC 11 products or product mixtures with FRAC 11 fungicides are labeled for use against powdery mildew but are not recommended for powdery mildew management in order to optimize FRAC 11 fungicide use for AFR management.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>triflumizole (Procure 480SC)</td>
<td>4 to 8 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>1 day</td>
<td>Check label for prohibited rotational crops. Do not plant leafy or fruiting vegetables within 30 days after application. Do not plant bulb or root vegetables within 60 days after application. Do not plant cotton, small cereal grains and all other crops not registered within 1 year of application. Do not apply more than 4 applications of product per crop per year. Do not apply more than 32 fl oz of product per crop per year. <strong>FRAC 3.</strong></td>
<td></td>
</tr>
<tr>
<td>myclobutanil (Rally 40WSP)</td>
<td>2.5 to 5 oz</td>
<td>E</td>
<td>24 hr</td>
<td>1 day</td>
<td>Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 oz of product per acre per year. <strong>FRAC 3.</strong></td>
<td></td>
</tr>
<tr>
<td>flutriafol (Rhyme)</td>
<td>5 to 7 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>Rhyme is registered for control of powdery mildew and for drip application to manage charcoal rot. Do not apply more than 4 applications per year. Do not apply more than 28 fl oz of product per acre per year. <strong>FRAC 3.</strong></td>
<td></td>
</tr>
<tr>
<td>quinoxyfen (Quintec)</td>
<td>4 to 6 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>1 day</td>
<td>Do not use more than 4 times per crop and no more than 2 times in a row before switching to a product with a different mode of action. Rotate with other mildewcides. Do not apply more than 24 fl oz of product per acre per crop. See label for additional restrictions. <strong>FRAC 3.</strong></td>
<td></td>
</tr>
<tr>
<td>flutianil (Gatten)</td>
<td>6.0 to 8.0 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 5 applications per year. Do not apply more than 0.132 lb flutianil per acre per year. Crop can be harvested after product has dried. <strong>Gatten is not registered for use in all states; check state registration status prior to use. FRAC U13.</strong></td>
<td></td>
</tr>
<tr>
<td>Pest/Problem</td>
<td>Management Options</td>
<td>Amount of Formulation per Acre</td>
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</tr>
<tr>
<td>Powdery mildew only (cont’d)</td>
<td>difenoconazole + cyprodinil (Inspire Super)</td>
<td>16.0 to 20.0 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 80 fl oz of Inspire Super per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.3 lb of cyprodinil per acre per year. <strong>FRAC 3 + 9.</strong></td>
</tr>
<tr>
<td></td>
<td>sulfur (various products and formulations)</td>
<td>See labels</td>
<td>G</td>
<td>See labels</td>
<td>See labels</td>
<td>Some products may be <strong>OMRI-listed.</strong> Spray as needed. Avoid using in middle of a hot sunny day that may cause leaf burning. See label for additional restrictions. <strong>FRAC M02.</strong></td>
</tr>
<tr>
<td>Anthracnose crown and fruit rot</td>
<td>Anthracnose crown rot (ACR) and anthracnose fruit rot (AFR) primarily come in with transplants. Inspect plants on arrival, and scout after establishment. If present, anthracnose on plants can cause petiole lesions (black sunken areas), stunting, and plant death. <strong>Captan and thiram are recommended for preventative fungicide applications at this time in the season. If anthracnose is confirmed on plants, see “Early Bloom (10%) and into Harvest” for more effective fungicide recommendations.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>captan (various)</td>
<td>See label</td>
<td>G</td>
<td>24 hr</td>
<td>1 day</td>
<td></td>
<td>See product labels for product and/or active ingredient season limits. In plantings known to be infected with the anthracnose crown rot pathogen, consider applying captan plus thiophanate-methyl (FRAC 1) at 10- to 14-day intervals for a total of 2 to 3 applications in the fall. <strong>FRAC M04.</strong></td>
</tr>
<tr>
<td>thiram (Thiram SC)</td>
<td>2.0 – 2.5 qt</td>
<td>F</td>
<td>24 hr</td>
<td>1 day</td>
<td></td>
<td>Thiram is a broad-spectrum fungicide similar to captan. Do not apply more than 5 applications (12.4 qt product per year west of the Mississippi River or more than 12 applications per year (29.7 qt product) east of the Mississippi River. See label for active ingredient limits per acre per year and for other restrictions. <strong>FRAC M03.</strong></td>
</tr>
</tbody>
</table>

***SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43 FOR ADDITIONAL DETAILS.***
## Post-planting: Arthropod Management

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Crickets</td>
<td>Carbaryl (Sevin 4F) (Sevin XLR)</td>
<td>1 to 2 qt 1 to 2 qt</td>
<td>G</td>
<td>12 hr</td>
<td>7 days</td>
<td>Repeated use of carbaryl may flare spider mite populations. DO NOT apply when bees are foraging. <strong>IRAC 1A.</strong></td>
</tr>
<tr>
<td></td>
<td>Malathion (Malathion 57 EC) (Malathion 8 Flowable) [other products available]</td>
<td>1.5 to 3 pt 1.5 to 2 pt See labels</td>
<td>F</td>
<td>12 hr</td>
<td>3 days</td>
<td>Apply when damage is first noted. DO NOT apply when bees are foraging. <strong>IRAC 1B.</strong></td>
</tr>
<tr>
<td></td>
<td>Bacillus thuringiensis (Bt) (many products)</td>
<td>See labels</td>
<td>G</td>
<td>See labels</td>
<td>See labels</td>
<td>Many Bt formulations are <strong>OMRI</strong>-listed. Bt insecticides have a short residual. Heavy infestations may need repeated applications. Applications are more effective against young larvae. <strong>IRAC 11B2.</strong></td>
</tr>
<tr>
<td></td>
<td>Carbaryl (Sevin 4F) (Sevin XLR)</td>
<td>1 to 2 qt 1 to 2 qt</td>
<td>G</td>
<td>12 hr</td>
<td>7 days</td>
<td>Repeated use of carbaryl can cause spider mite problems. Apply late in the day when plants clipped at the base are first noticed. DO NOT apply when bees are foraging. <strong>IRAC 1A.</strong></td>
</tr>
<tr>
<td></td>
<td>Malathion (Malathion 57 EC) (Malathion 8 Flowable)</td>
<td>1.5 to 3 pt 1.5 to 2 pt</td>
<td>G</td>
<td>12 hr</td>
<td>3 days</td>
<td>Malathion 8 Flowable can be applied via drip lines, allowing treatment under plastic if cutworms are present. <strong>IRAC 1B.</strong></td>
</tr>
<tr>
<td>Cyclamen mite</td>
<td>Abamectin (Agri-Mek SC)</td>
<td>3.5 fl oz</td>
<td>VG</td>
<td>12 hr</td>
<td>3 days</td>
<td>Apply in sufficient water to obtain good coverage into the crown of the plant. To avoid illegal residues, Agri-Mek must be mixed with a non-ionic type of wetting/spreading/penetrating adjuvant. Do not use a binder sticker type adjuvant. <strong>IRAC 6.</strong></td>
</tr>
</tbody>
</table>
### Post-planting: Arthropod Management

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</tr>
</thead>
<tbody>
<tr>
<td>Cyclamen mite (cont’d)</td>
<td>fenpyroximate (Portal XLO)</td>
<td>2 pt</td>
<td>ND</td>
<td>12 hr</td>
<td>1 day</td>
<td>Limited data on Portal is available in the Southeast. <strong>IRAC 21A.</strong></td>
</tr>
<tr>
<td>Strawberry clipper</td>
<td>All common plasticulture varieties and many matted row varieties compensate for bud loss due to strawberry clipper injury, and clippers do not typically justify treatment. Materials effective against clippers are also toxic to honey bees.</td>
<td></td>
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</tr>
<tr>
<td>bifenthrin (Brigade WSB)</td>
<td>6.4 to 32 oz</td>
<td>VG</td>
<td>12 hr</td>
<td>0 days</td>
<td>DO NOT apply when bees are foraging. <strong>IRAC 3.</strong></td>
<td></td>
</tr>
<tr>
<td>fenpropothrin (Danitol 2.4 EC)</td>
<td>16 to 21.33 fl oz</td>
<td>VG</td>
<td>24 hr</td>
<td>2 days</td>
<td>DO NOT make more than 2 applications per crop per season. Apply in at least 100 gal of water per acre. DO NOT apply when bees are foraging. <strong>IRAC 3A.</strong></td>
<td></td>
</tr>
<tr>
<td>carbaryl (Sevin XLR)</td>
<td>1 to 2 qt</td>
<td>G</td>
<td>12 hr</td>
<td>7 days</td>
<td>If carbaryl is your material of choice for strawberry clippers, Sevin XLR will have a lower impact on bees. Apply material at dusk when bees are not foraging and allow the maximum amount of dry time before bees become active. <strong>IRAC 1A.</strong></td>
<td></td>
</tr>
<tr>
<td>Twospotted spider mite</td>
<td>Check with local Cooperative Extension specialists to determine twospotted spider mite treatment thresholds in your area.</td>
<td></td>
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</tr>
<tr>
<td>Predatory mites (Phytoseiulus persimilis, Neoseiulus fallacis, and others)</td>
<td>Release rates vary based upon predatory species and prey density</td>
<td>Very important Effectiveness: VG</td>
<td>N/A</td>
<td>N/A</td>
<td>In general, release 2 to 3 mites per plant when mite populations are low and 5 predators per plant when populations are high. Predatory mite releases must be initiated at or before twospotted spider mites reach threshold levels (5 mites per leaflet), and spider mite populations must be followed closely after predatory mite releases because they may vary in efficacy. Consult supplier for best implementation practices as species differ in attributes, and delays in observable reduction of spider mites may be observed. Predatory mites may be affected by broad-spectrum insecticides; multiple releases may be required. For more information, see the Small Fruit News article “Twospotted spider mite and integration of biocontrol.”</td>
<td></td>
</tr>
<tr>
<td>acequinocyl (Kanemite 15 SC)</td>
<td>21 to 31 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>1 day</td>
<td>Allow 21 days between treatments. Do not make more than 2 applications per season. Use in a minimum of 100 gal/acre. Use in a minimum of 100 gal/acre. <strong>IRAC 20B.</strong></td>
<td></td>
</tr>
<tr>
<td>Pest/Problem</td>
<td>Management Options</td>
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</tr>
<tr>
<td>Twospotted spider mite (cont’d)</td>
<td>bifenazate (Acramite 50WS) (Acramite-4SC)</td>
<td>0.75 to 1 lb, 12 to 16 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>1 day</td>
<td><strong>Acramite 50WS</strong>: Allow 21 days between treatments. Do not make more than 2 applications per season. Use in a minimum of 100 gal/acre. <strong>Acramite-4SC</strong>: Allow 21 days between treatments. Do not make more than 2 applications per crop cycle with up to 2 crop cycles per year. <strong>IRAC 20D.</strong></td>
</tr>
<tr>
<td></td>
<td>bifenazate (Vigilant 4SC)</td>
<td>12 to 16 fl oz</td>
<td>ND (likely similar to Acramite)</td>
<td>12 hr</td>
<td>1 day</td>
<td>Use only 2 applications per year. Use in a minimum of 50 gal/acre. Allow 14 days between applications. Use an effective miticide with a different mode of action between applications. <strong>IRAC 25.</strong></td>
</tr>
<tr>
<td></td>
<td>cyflumetofen (Nealta)</td>
<td>13.7 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spiromesifen (Oberon 2 SC)</td>
<td>12 to 16 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>3 days</td>
<td>Make no more than 3 applications per crop. Use in a minimum of 100 gal/acre. <strong>IRAC 23.</strong></td>
</tr>
<tr>
<td></td>
<td>abamectin (Agri-Mek SC)</td>
<td>3.5 fl oz</td>
<td>VG</td>
<td>12 hr</td>
<td>3 days</td>
<td>Make 2 applications 7 to 10 days apart when mites first appear. Do not exceed 64 fl oz per acre in a growing season. Apply in a minimum of 100 gal of water per acre. Do not repeat treatment within 21 days of second application. For resistance management, do not use in strawberry nurseries. <strong>IRAC 6.</strong></td>
</tr>
<tr>
<td></td>
<td>etoxazole (Zeal 72 WSP)</td>
<td>2 to 3 oz</td>
<td>VG</td>
<td>12 hr</td>
<td>1 day</td>
<td>Make only 1 application per crop. DO NOT apply more than 3 oz per acre per crop. Use in a minimum of 100 gal/acre. <strong>IRAC 10B.</strong></td>
</tr>
<tr>
<td></td>
<td>fenpyroximate (Portal XLO)</td>
<td>2 pt</td>
<td>VG</td>
<td>12 hr</td>
<td>1 day</td>
<td>Do not make more than 2 applications per crop cycle. Allow 14 days between applications. Use in a minimum of 25 gal/acre. <strong>IRAC 21A.</strong></td>
</tr>
<tr>
<td></td>
<td>hexythiazox (Savey 50 DF)</td>
<td>6 oz</td>
<td>VG</td>
<td>12 hr</td>
<td>3 days</td>
<td>Controls eggs and immature mites but not adults. Use only once. DO NOT apply more than 6 oz per crop, 1 application per year. DO NOT use in strawberry nurseries. If many adult mites are present, use a material effective on adult mites, such as Agri-Mek. <strong>IRAC 10A.</strong></td>
</tr>
<tr>
<td></td>
<td>insecticidal soap (M-Pede)</td>
<td>1 to 2 gal per 100 gal</td>
<td>F</td>
<td>12 hr</td>
<td>0 days</td>
<td>Thorough coverage is needed. Plant damage has been noted under particularly cold or hot conditions. For best results begin use with low mite populations.</td>
</tr>
</tbody>
</table>
## Post-planting: Arthropod Management

<table>
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<tr>
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<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Twospotted spider mite (cont’d)</td>
<td>rosemary &amp; peppermint oils (Ecotec Plus)</td>
<td>1 to 4 pt per 100 gal or 2 to 6 fl oz per 10 gal or 1 to 4 pt per 100 gal</td>
<td>F</td>
<td>0 hr</td>
<td>0 days</td>
<td>Because oils lack the residual activity of conventional insecticides, they may need to be applied repeatedly for control. Plant damage has been noted for some oils under some weather conditions. Ecotec and Ecotrol are OMRI-listed.</td>
</tr>
<tr>
<td></td>
<td>(Ecotrol Plus)</td>
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<tr>
<td></td>
<td>sucrose octanoate (SucraShield)</td>
<td>0.8 to 1.0 % v/v</td>
<td>F</td>
<td>48 hr</td>
<td>0 days</td>
<td>Data for SucraShield against twospotted spider mites are limited. Apply in a volume of 100 to 200 gal per acre. OMRI-listed.</td>
</tr>
<tr>
<td></td>
<td>horticultural oils (JMS Stylet Oil)</td>
<td>3 qt per 100 gal</td>
<td>G</td>
<td>4 hr</td>
<td>0 days</td>
<td>Oils should not be applied 48 hr or less before freezing temperature, at temperatures over 90 °F, or to water-stressed plants. Use sufficient water to achieve coverage; a volume of 100 to 200 gal per acre is recommended. For best results begin use with low mite populations. Because oils lack the residual activity of conventional insecticides, they may need to be applied repeatedly to control mites. Organic JMS Stylet Oil is OMRI-listed.</td>
</tr>
<tr>
<td></td>
<td>(Organic JMS Stylet Oil)</td>
<td></td>
<td></td>
<td>4 hr</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Omni Supreme Spray)</td>
<td></td>
<td></td>
<td>12 hr</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[other products available]</td>
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### New Leaf Growth to Pre-bloom: Disease Management

<table>
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<tr>
<td><strong>CAUTION:</strong> Some fungicides may negatively impact bees during bloom. When possible, 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.</td>
<td></td>
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</tr>
<tr>
<td>Anthracnose crown rot and fruit rot</td>
<td>ACR and AFR</td>
<td></td>
<td>G</td>
<td>24 hr</td>
<td>1 day</td>
<td>See product labels for product and/or active ingredient season limits. In plantings known to be infected with the anthracnose crown rot pathogen, consider applying captan plus thiophanate-methyl (FRAC 1) at 10- to 14-day intervals for a total of 2 to 3 applications in the fall. FRAC M04.</td>
</tr>
<tr>
<td></td>
<td>captan (various)</td>
<td>See label</td>
<td>F</td>
<td>24 hr</td>
<td>1 day</td>
<td>Thiram is a broad-spectrum fungicide similar to captan. Do not apply more than 5 applications (12.4 qt product) per year west of the Mississippi River or more than 12 applications per year (29.7 qt product) east of the Mississippi River. See label for active ingredient limits per acre per year and for other restrictions. FRAC M03.</td>
</tr>
<tr>
<td><strong>Botrytis crown rot</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*** SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***</td>
</tr>
<tr>
<td>Botrytis crown rot</td>
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<tr>
<td></td>
<td>iprodione (Rovral 4F)</td>
<td>(foliar spray) 1.5 to 2 pt (alone) 1.0 pt (tank-mix)</td>
<td>VG</td>
<td>24 hr</td>
<td>See comments</td>
<td>Do not apply after first fruiting flower. Do not make more than one application of product per season. Do not apply more than 2 pt of product per acre per season (stand-alone) or 1 pt of product per acre per season (tank-mix). Crown rot control during the early winter and prior to bloom may be the most effective use of the one Rovral application allowed in strawberries. FRAC 2.</td>
</tr>
<tr>
<td></td>
<td>captan (various)</td>
<td>See labels</td>
<td>F</td>
<td>24 hr</td>
<td>1 day</td>
<td>See product labels for product and/or active ingredient season limits. FRAC M04.</td>
</tr>
<tr>
<td><strong>Botrytis crown rot</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*** SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***</td>
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*** SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***
### New Leaf Growth to Pre-bloom: Disease Management

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<tbody>
<tr>
<td><strong>Botrytis crown rot (cont’d)</strong></td>
<td>thiram (Thiram SC)</td>
<td>1.5 – 2.5 qt</td>
<td>F</td>
<td>24 hr</td>
<td>1 day</td>
<td>Thiram is a broad-spectrum fungicide similar to captan. Do not apply more than 5 applications (12.4 qt product) per year west of the Mississippi River or more than 12 applications per year (29.7 qt product) east of the Mississippi River. See label for active ingredient limits per acre per year and for other restrictions. <strong>FRAC M03.</strong></td>
</tr>
<tr>
<td><strong>Botrytis crown rot and fruit rot</strong></td>
<td>Remove dead and dying leaves just before bloom</td>
<td>N/A</td>
<td>Importance: F</td>
<td>Efficacy: G</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**CAUTION**: Some fungicides may negatively impact bees during bloom. When possible, 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.

**Leaf spots, leaf blights, and powdery mildew**: Generally do not become economically important diseases in the fall or early spring. Thus, fungicides are generally not required for these problems. Thresholds have not been established, so the need for fungicides should be determined on a farm-by-farm basis depending on the disease pressure present. These diseases may be associated with plant sources; therefore, disease incidence can vary from year to year. Warm, wet weather favors disease progress. In the spring, monitor fields closely observing the underside of strawberry leaves to determine if powdery mildew is present. See previous notes on powdery mildew on pages 27. FRAC 11 products or mixtures with FRAC 11 fungicides are labeled but not listed to manage powdery mildew and leaf spots in order to optimize FRAC 11 fungicide use for anthracnose fruit rot control.

#### Common leaf spot, leaf scorch, leaf blight (e.g., Mycosphaerella, Phomopsis, Gnomonia)

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Amount of Formulation</th>
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<tbody>
<tr>
<td>myclobutanil (Rally 40WSP)</td>
<td>2.5 to 5 oz</td>
<td>VG</td>
<td>24 hr</td>
<td>1 day</td>
<td>Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 oz of product per acre per year. <strong>FRAC 3.</strong></td>
</tr>
<tr>
<td>captan (various) + thiophanate-methyl (Topsin M WSB) [other products available]</td>
<td>See labels</td>
<td>G</td>
<td>24 hr</td>
<td>1 day</td>
<td>When foliar symptoms appear, make 1 or 2 captan applications plus thiophanate-methyl (FRAC 1) at a 10- to 14-day interval for better control than captan products alone would provide. See product labels for product and/or active ingredient season limits. Do not tank mix captan products with highly alkaline pesticides, such as Bordeaux mixture. <strong>See resistance management notes on page 27. FRAC M04 + FRAC 1.</strong></td>
</tr>
<tr>
<td>captan (various)</td>
<td>See labels</td>
<td>F</td>
<td>24 hr</td>
<td>1 day</td>
<td>See product labels for product and/or active ingredient season limits. Do not tank mix captan products with highly alkaline pesticides, such as Bordeaux mixture. <strong>See resistance management notes on page 27. FRAC M04.</strong></td>
</tr>
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</table>
## New Leaf Growth to Pre-bloom: Disease Management

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<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
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<tbody>
<tr>
<td>Powdery mildew only</td>
<td>triflumizole (Procure 480SC)</td>
<td>4 to 8 fl oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>1 day</td>
<td>Check label for prohibited rotational crops. Do not plant leafy or fruiting vegetables within 30 days after application. Do not plant bulb or root vegetables within 60 days after application. Do not plant cotton, small cereal grains and all other crops not registered within 1 year of application. Do not apply more than 4 applications of product per crop per year. Do not apply more than 32 fl oz of product per crop per year. <strong>FRAC 3.</strong></td>
</tr>
<tr>
<td></td>
<td>myclobutanil (Rally 40WSP)</td>
<td>2.5 to 5 oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>24 hr</td>
<td>1 day</td>
<td>Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 oz of product per acre per year. <strong>FRAC 3.</strong></td>
</tr>
<tr>
<td></td>
<td>flutriafol (Rhyme)</td>
<td>5 to 7 fl oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>Rhyme is registered for control of powdery mildew and for drip application to manage charcoal rot. Do not apply more than 4 applications per year. Do not apply more than 28 fl oz of product per acre per year. <strong>FRAC 3.</strong></td>
</tr>
<tr>
<td></td>
<td>quinoxyfen (Quintec)</td>
<td>4 to 6 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>1 day</td>
<td>Do not use more than 4 times per crop and no more than 2 times in a row before switching to a product with a different mode of action. Rotate with other mildewcides. Do not apply more than 24 fl oz of product per acre per crop. See label for additional restrictions. <strong>FRAC 13.</strong></td>
</tr>
<tr>
<td></td>
<td>flutianil (Gatten)</td>
<td>6.0 to 8.0 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 5 applications per year. Do not apply more than 0.132 lb flutianil per acre per year. Crop can be harvested after product has dried. <strong>Gatten is not registered for use in all states; check state registration status prior to use. FRAC U13.</strong></td>
</tr>
<tr>
<td></td>
<td>difenoconazole + cyprodinil (Inspire Super)</td>
<td>16.0 to 20.0 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 80 fl oz of Inspire Super per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.3 lb of cyprodinil per acre per year. <strong>FRAC 3 + 9.</strong></td>
</tr>
<tr>
<td></td>
<td>cyflufenamid (Torino)</td>
<td>3.4 oz</td>
<td>VG</td>
<td>4 hr</td>
<td>0 days</td>
<td>Do not make more than 2 applications per year. Do not apply more than 6.8 oz of product per acre per calendar year. Do not apply more than once every 14 days. <strong>FRAC U06.</strong></td>
</tr>
</tbody>
</table>

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**CAUTION:** Some fungicides may negatively impact bees during bloom. When possible, 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.
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<tbody>
<tr>
<td>Powdery mildew only (cont’d)</td>
<td>propiconazole (Tilt) [other products available]</td>
<td>4 fl oz See labels</td>
<td>VG R</td>
<td>24 hr See labels</td>
<td>0 days See labels</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 16 fl oz of Tilt per acre per year. Do not apply more than 4 applications of Tilt per year. Do not apply more than 0.45 lb of propiconazole per acre per year. See other product labels for product specific limits. FRAC 3.</td>
</tr>
<tr>
<td>Angular (bacterial) leaf spot (Xanthomonas fragariae)</td>
<td>sulfur (various products and formulations)</td>
<td>See labels</td>
<td>G</td>
<td>See labels See labels</td>
<td>Some products may be OMRI-listed. Spray as needed. Avoid using in middle of a hot sunny day that may cause leaf burning. See label for additional restrictions. FRAC M02.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>copper (basic copper sulfate, copper hydroxide, copper salts of fatty and rosin acids, cuprous oxide) (various products and formulations)</td>
<td>See labels</td>
<td>P</td>
<td>See labels See labels</td>
<td>Angular (bacterial) leaf spot can be a serious problem during cool, wet conditions. These compounds provide some control unless conditions highly favor disease. Repeat applications at 7- to 10-day intervals. Discontinue when phytotoxicity appears, usually after 4 to 5 applications. Check product labels to be sure that products are labeled for use on strawberry. Individual products have various percentages of active ingredient. Follow all instructions on the specific product label. FRAC M01.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>acibenzolar-S-methyl (Actigard 50WG)</td>
<td>0.5 to 0.75 oz</td>
<td>P</td>
<td>12 hr 0 days</td>
<td>For suppression. Do not apply within 5 days of transplanting. Do not apply to stressed plants. Do not apply more than 6 oz of product per acre per year. Actigard is a plant activator and has no direct activity on the bacteria. FRAC P01.</td>
<td></td>
</tr>
<tr>
<td>Red stele; Phytophthora crown/root rots</td>
<td>mefenoxam (Ridomil Gold SL) (Ultra Flourish)</td>
<td>1 pt/A 2 pt/A</td>
<td>VG</td>
<td>See label See label</td>
<td>0 days 0 days</td>
<td>Strawberry plants initiate considerable root growth in the early spring. Time control applications in problem fields when new growth begins in the spring. Apply in sufficient water to move the fungicide into the root zone. <strong>See labels for instructions regarding rates to be used in drip and band applications.</strong> **REI varies and is dependent upon method of application. FRAC 4. See labels for limits of mefenoxam containing products per crop. Ridomil Gold SL: Do not exceed 3 applications per crop. Ultra Flourish: Do not exceed 6 pt per acre per year.</td>
</tr>
</tbody>
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<tbody>
<tr>
<td>oxathiapiprolin + mefenoxam</td>
<td>(Imidacloprid)</td>
<td>2.5 to 5.0 pt</td>
<td>F</td>
<td>4 hr</td>
<td>0 days</td>
<td>Phosphite-based chemicals are not as effective as Ridomil Gold. Consider phosphites if the pathogen is known to be resistant to mefenoxam or if strawberry plants have poor root systems AND foliage is healthy for chemical uptake. Do not apply more than 30 lb of Aliette WDG per acre per season. <strong>Check the registration status of products prior to use. Not all products are registered for use in all states. Counties in some states, including AR, KY, LA, MS, and NC, have further restrictions for Aliette WDG use.</strong> Check product labels for specific instructions, cautions, and restrictions. <strong>FRAC P07.</strong></td>
</tr>
<tr>
<td>phosphites</td>
<td>(ProPhyt)</td>
<td>(foliar)</td>
<td>F</td>
<td>4 hr</td>
<td>See label</td>
<td>Phosphite-based chemicals are not as effective as Ridomil Gold. Consider phosphites if the pathogen is known to be resistant to mefenoxam or if strawberry plants have poor root systems AND foliage is healthy for chemical uptake. Do not apply more than 30 lb of Aliette WDG per acre per season. <strong>Check the registration status of products prior to use. Not all products are registered for use in all states. Counties in some states, including AR, KY, LA, MS, and NC, have further restrictions for Aliette WDG use.</strong> Check product labels for specific instructions, cautions, and restrictions. <strong>FRAC P07.</strong></td>
</tr>
<tr>
<td>fosetyl-Al</td>
<td>(Aliette WDG)</td>
<td>(foliar)</td>
<td>F</td>
<td>24 hr</td>
<td>12 hr</td>
<td>Phosphite-based chemicals are not as effective as Ridomil Gold. Consider phosphites if the pathogen is known to be resistant to mefenoxam or if strawberry plants have poor root systems AND foliage is healthy for chemical uptake. Do not apply more than 30 lb of Aliette WDG per acre per season. <strong>Check the registration status of products prior to use. Not all products are registered for use in all states. Counties in some states, including AR, KY, LA, MS, and NC, have further restrictions for Aliette WDG use.</strong> Check product labels for specific instructions, cautions, and restrictions. <strong>FRAC P07.</strong></td>
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**CAUTION:** Some fungicides may negatively impact bees during bloom. When possible, 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.
## Pre-bloom to Harvest: Arthropod Management

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
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<tr>
<td><strong>CAUTION:</strong> Insecticides may negatively impact bees during bloom. 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.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Aphids</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>flupyradifurone (Sivanto 200 SL)</td>
<td>7.0 to 10.5 fl oz</td>
<td>VG</td>
<td>4 hr</td>
<td>0 days</td>
<td>Do not tank mix with azole fungicides (FRAC 3) during bloom period. Apply no more often than every 10 days and no more than 28 fl oz per acre per year. IRAC 4D.</td>
</tr>
<tr>
<td></td>
<td>imidacloprid (Admire Pro)</td>
<td>10.5 to 14 fl oz (soil) 1.3 fl oz (foliar)</td>
<td>VG</td>
<td>12 hr</td>
<td>14 days 7 days</td>
<td>Can be applied through drip irrigation or as a foliar spray. DO NOT apply when bees are foraging or within 10 days of bloom. IRAC 4A.</td>
</tr>
<tr>
<td></td>
<td>thiamethoxam (Platinum) (Actara)</td>
<td>5 to 12 fl oz (soil) 1.5 to 3 oz (foliar)</td>
<td>G</td>
<td>12 hr</td>
<td>50 days 3 days</td>
<td>DO NOT apply when bees are foraging; after a Platinum or Actara application, WAIT FIVE DAYS before placing beehives into treated fields. Platinum: Do not apply more than 12 fl oz per acre per year. Actara: Do not apply more than 12 oz per acre per year. Allow 10 days between applications. Note: The long PHI for Platinum makes it useful only as a post-transplant material. IRAC 4A.</td>
</tr>
<tr>
<td></td>
<td>bifenthrin (Brigade 10 WSB)</td>
<td>6.4 to 32 oz</td>
<td>G</td>
<td>12 hr</td>
<td>0 days</td>
<td>The use of broad-spectrum insecticides during bloom will damage honey bee populations. DO NOT apply when bees are foraging. Refer to label. IRAC 3A.</td>
</tr>
<tr>
<td></td>
<td>malathion (Malathion 57 EC) [other products available]</td>
<td>1.5 pt See labels</td>
<td>F</td>
<td>12 hr See labels See labels</td>
<td>DO NOT apply when bees are foraging. IRAC 1B.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>insecticidal soap (M-Pede)</td>
<td>1 to 2 gal per 100 gal</td>
<td>F</td>
<td>12 hr</td>
<td>0 days</td>
<td>Thorough coverage is needed. Plant damage has been noted under some weather conditions.</td>
</tr>
</tbody>
</table>

Cutworms

See [Post-planting: Arthropod Management](#) recommendations.
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<tr>
<td><strong>Flower thrips</strong></td>
<td>There are multiple flower thrips species that are difficult to distinguish in the field. Species differ in their ease of control and ability to transmit viruses. Thrips populations rarely or sporadically require treatment in strawberries. Thrips may be more problematic in hot, dry years. Because materials effective against thrips are often toxic to pollinators, only treat if damaging populations are present and apply materials in the evening to allow for maximum time between application and bee foraging activity. If using insecticides to manage thrips, rotate between different classes if more than one treatment is made.</td>
<td></td>
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</tr>
<tr>
<td>acetamiprid (Assail 30 SG)</td>
<td>4.0 to 6.9 oz</td>
<td>G</td>
<td>12 hr</td>
<td>1 day</td>
<td>Do not apply when bees are foraging. Assail will not control western flower thrips. <strong>IRAC 4A.</strong></td>
<td></td>
</tr>
<tr>
<td>spinosad (Entrust 80W) (Entrust SC)</td>
<td>1.25 to 2 oz 4 to 6 fl oz</td>
<td>G</td>
<td>4 hr</td>
<td>1 day</td>
<td>Rotate to a different class of insecticide after 2 successive applications. See product labels for season limits and additional restrictions. Entrust is OMRI-listed. Spinosad is highly toxic to pollinators when wet. If treatment is necessary, treat in the evening when bees are not foraging to allow for maximum dry time. <strong>IRAC 5.</strong></td>
<td></td>
</tr>
<tr>
<td>spinetoram (Radiant SC)</td>
<td>6 to 10 fl oz</td>
<td>G</td>
<td>4 hr</td>
<td>1 day</td>
<td>Spinetoram is highly toxic to pollinators when wet. If treatment is necessary, treat in the evening when bees are not foraging to allow for maximum dry time. <strong>IRAC 5.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Imported fire ants</strong></td>
<td>Ensure that ants are actively foraging before applying baits.</td>
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</tr>
<tr>
<td>pyriproxyfen (Esteem Ant Bait 0.5% B)</td>
<td>1.5 to 2 lb</td>
<td>VG</td>
<td>12 hr</td>
<td>1 day</td>
<td>Esteem Ant Bait is an insect growth regulator (IGR) and acts on the reproductive activity of the queen(s). Apply when ants are actively foraging. Apply during dry weather; do not water for 24 hr after application. See label for individual mound treatment instructions. <strong>IRAC 7C.</strong></td>
<td></td>
</tr>
<tr>
<td>methoprene (Extinguish Professional Fire Ant Bait 0.5 % B)</td>
<td>0.75 lb (broadcast)</td>
<td>VG</td>
<td>4 hr</td>
<td>0 days</td>
<td>Extinguish is an IGR and acts on the reproductive activity of the queen(s). Allow at least 3 weeks to see reduction in mound activity and 8 to 10 weeks for mound elimination. Extinguish can be applied as a broadcast or individual mound treatment. See label for instructions for treatment of individual mounds. <strong>IRAC 7A.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Slugs and snails</strong></td>
<td>iron phosphate (Sluggo Snail and Slug Bait)</td>
<td>20 to 44 lb</td>
<td>G</td>
<td>0 hr</td>
<td>0 days</td>
<td>Apply in the evening. Some iron phosphate formulations are OMRI-listed, check the label.</td>
</tr>
</tbody>
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<td></td>
<td></td>
</tr>
<tr>
<td>Slugs and snails (cont’d)</td>
<td>metaldehyde (Deadline Bullets) (Deadline M-Ps)</td>
<td>See label</td>
<td>G</td>
<td>12 hr</td>
<td>0 days</td>
<td>Metaldehyde is a systemic toxin. There is no antidote. Application of this product is prohibited unless children and domestic animals can be excluded from the treated area from the start of the application until applied material is no longer visible. <strong>SEE LABELS FOR PRECAUTIONS AND DIRECTIONS FOR USE.</strong> **Apply products as a soil surface treatment. Use a band treatment between plant rows. A maximum of three applications are allowed per season. **This is a molluscicide (no IRAC code).</td>
</tr>
<tr>
<td>Strawberry clipper</td>
<td>See <a href="#">Post-Planting: Arthropod Management</a> recommendations.</td>
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</tr>
<tr>
<td>Twospotted spider mite</td>
<td>See <a href="#">Post-Planting: Arthropod Management</a> recommendations.</td>
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Early Bloom (10%) and into Harvest: Disease Management

The primary diseases of concern at early bloom and into harvest are Botrytis fruit rot (BFR) and anthracnose fruit rot (AFR). Several key principles should be kept in mind:

1. Abound, Cabrio, Merivon, Pristine, Luna Sensation, and some others belong to the same family of chemicals (QoIs; FRAC 11). Pyraclostrobin (Cabrio, Merivon, and Pristine) has offered better control of AFR in recent research efforts. **No more than two applications of a FRAC 11 fungicide should be made per season for resistance management.** Strategic timing is necessary. Pristine, Luna Sensation, and Merivon also have a second chemical that has good broad-spectrum activity against a number of diseases, especially those caused by Botrytis. QoI resistance has been found in ‘acutatum’ populations in the south. The problem tends to be plant-source-associated.

2. Captan (FRAC M04), thiram (FRAC M03), and Switch (FRAC 9+12) offer a broad spectrum of disease control. Switch is modest against AFR in NC research.

3. Polyoxin D zinc salt (FRAC 19; Ph-D and OSO 5%SC) is as effective as captan for Botrytis at high label rates and can help reduce reliance on fungicides that have resistance concerns.

4. **Eleven should not be used more than twice per season due to resistance concerns.** It is effective against Botrytis but no other fungal pathogens.

5. **High risk fungicides of the same chemical class (FRAC group) should not be applied in consecutive applications.**

6. Bloom sprays are the most important for managing Botrytis, because 90% of fruit infection occurs through the flower at bloom. Recent research suggests bloom sprays are also critical for AFR control.

7. Fruit rot diseases develop rapidly during wet periods or in poorly ventilated locations. Control is easier when initiated before the problem develops. Spray coverage is important and dependent on nozzle condition, tractor speed, pressure, and plant density. Spray coverage can be checked with water sensitive cards.

**Fungicide Selection for Botrytis and Anthracnose Fruit Rot Management**

Management of Botrytis fruit rot (BFR) and anthracnose fruit rot (AFR) caused by “Colletotrichum acutatum” has become more complex. Growers need to use products that work against resistant strains of BFR and manage AFR. We developed a new table to help with the decision process (see table on page 45).

The table (right) shows our current understanding of the efficacy of fungicides for the Southeastern U.S. (north of Florida). Efficacy in the table is indicated as follows: E = excellent, VG = very good, G = good, F = fair, P = poor. A large number of farms are experiencing problems with Botrytis strains that are resistant to one or more fungicide. (Color codes match the codes in the MyIPM App).

**BOTRYTIS CONTROL:** Botrytis cinerea historically has a high potential to develop resistance. Therefore, it is important to give these recommendations serious consideration:

1. If a Botrytis spray is needed before bloom (e.g., to control Botrytis crown rot) use Rovral (FRAC 2).

2. **Use members of any FRAC group (except M03 or M04) no more than twice per season.** (For example, if you used Fontelis once and Merivon once you maxed out the 2 applications for FRAC 7 fungicides.)

<table>
<thead>
<tr>
<th>Product</th>
<th>FRAC Group</th>
<th>BFR</th>
<th>Botrytis Resistance</th>
<th>AFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captain</td>
<td>M04</td>
<td>G</td>
<td>None</td>
<td>G</td>
</tr>
<tr>
<td>Thiram</td>
<td>M03</td>
<td>G</td>
<td>None</td>
<td>F</td>
</tr>
<tr>
<td>Topsin M</td>
<td>1</td>
<td>Not effective</td>
<td>Widespread</td>
<td>Not effective</td>
</tr>
<tr>
<td>Rovral</td>
<td>2</td>
<td>G</td>
<td>Prevalent</td>
<td>Not effective</td>
</tr>
<tr>
<td>Tilt; generics</td>
<td>3</td>
<td>Not effective</td>
<td>Not applicable</td>
<td>F</td>
</tr>
<tr>
<td>Fontelis</td>
<td>7</td>
<td>E</td>
<td>Prevalent</td>
<td>F</td>
</tr>
<tr>
<td>Kenja</td>
<td>7</td>
<td>E</td>
<td>NOT prevalent</td>
<td>F</td>
</tr>
<tr>
<td>Scala</td>
<td>9</td>
<td>G</td>
<td>Prevalent</td>
<td>Not effective</td>
</tr>
<tr>
<td>Pristine</td>
<td>7 + 11</td>
<td>G</td>
<td>Prevalent</td>
<td>E*</td>
</tr>
<tr>
<td>Merivon</td>
<td>7 + 11</td>
<td>E</td>
<td>Prevalent</td>
<td>E*</td>
</tr>
<tr>
<td>Luna Sensation</td>
<td>7 + 11</td>
<td>E</td>
<td>NOT prevalent</td>
<td>E*</td>
</tr>
<tr>
<td>Quadris Top, Quilt Xcel</td>
<td>3 + 11</td>
<td>F</td>
<td>Widespread</td>
<td>E*</td>
</tr>
<tr>
<td>Cabrio, Abound, Flint Extra</td>
<td>11</td>
<td>F</td>
<td>Widespread</td>
<td>E*</td>
</tr>
<tr>
<td>Miravis Prime</td>
<td>12 + 7</td>
<td>E**</td>
<td>NOT prevalent**</td>
<td>E**</td>
</tr>
<tr>
<td>Switch</td>
<td>12 + 9</td>
<td>E</td>
<td>NOT prevalent</td>
<td>G</td>
</tr>
<tr>
<td>Elevate</td>
<td>17</td>
<td>E</td>
<td>Prevalent</td>
<td>Not effective</td>
</tr>
<tr>
<td>Ph-D, OSO</td>
<td>19</td>
<td>G</td>
<td>NOT prevalent</td>
<td>F</td>
</tr>
</tbody>
</table>

*Resistance issues to FRAC 11 fungicides in the AFR pathogen have been reported in multiple states. Problems tend to be plant-source-associated.

**Efficacy ratings are tentative based on the performance of similar products and laboratory studies.
BOTRYTIS CONTROL (cont’d):

3. Resistance profiles vary from farm-to-farm. Sample BFR populations for their resistance profile through Clemson University for a fee. Contact the Clemson Molecular Pathogen & Pest Detection (MPPD) Lab (https://www.clemson.edu/public/regulatory/plant-problem/mppd-lab/index.html) for details regarding sample submission and testing.

   Based on samples submitted to the University of Georgia, the Fungicide Decision Management Table below shows a decision guide to manage BFR. If you do not know your profile, it is best to avoid over-reliance on products where resistance is prevalent. If in doubt, follow Decision Code E-1 since this will address the most common resistance issues for BFR control. If you also have FRAC 11 resistance for AFR, follow Decision Code E-2.

4. Specific plant sources may be identified as having AFR infestations. In that case growers need to manage both BFR and AFR.

AFR CONTROL: Resistance to FRAC 11 fungicides (e.g., Abound, Cabrio, Luna Sensation, Merivon, Pristine) has been found in Florida, North Carolina, and California; problems tend to be plant-source associated. Therefore, it is a good idea to use the FRAC 11 fungicides only in a mixture at the lower labeled rate with the higher labeled rate of captan products (e.g., Captan; FRAC M04) alternated with captan alone. If you know the resistance profile, see the Fungicide Decision Management Table below. Also, recently, we have documented reduced activity with azoxystrobin (e.g., Abound, etc.; FRAC 11) with certain strains of the AFR pathogen. Cabrio (FRAC 11) and FRAC 7 + 11 products have offered better control of AFR in recent research efforts and if the strains are not resistant to FRAC 11 fungicides.

FRAC 7 + 11 products can be used if your resistance profile shows the FRAC 7 component is still effective against BFR. If FRAC 7 resistance is diagnosed or you don’t know, we recommend using Cabrio (plus captan). Like BFR, our data shows early bloom sprays are also critically important for AFR management.

For cases when there is no anthracnose and growers need to focus on Botrytis control (most fields), follow Decision Code A.

Options: For a reduced fungicide program, initiate applications at FIRST bloom as above, but apply subsequent sprays before predicted wet weather that favors Botrytis; end applications about 26 to 30 days before expected final harvests. Increase the time between spray applications when dry weather persists. Research trials have documented that 4 sprays during bloom often are sufficient to offer seasonlong BFR control. Also, consult available forecasting models linked through this guide.

For cases when anthracnose is present and there is no known resistance within the Botrytis population, follow Decision Code B-1.

Before predicted periods of cool and wet weather during bloom, use Switch (FRAC 12 + 9) for better Botrytis control. Use Switch with captan if Botrytis pressure is expected to be heavy. Switch also has decent anthracnose control. FRAC 7 + 11 products or Cabrio show the best efficacy against AFR under high anthracnose pressure in research studies and either can be used if there is no resistance to FRAC 7 fungicides (an active ingredient in FRAC 7 + 11 products). Also, if weather conditions (warm & wet) favor AFR or you start to approach the upper limit of FRAC 11 fungicides allowed (4 to 5 applications), consider rotating to a tank-mix of captan + Tilt (FRAC 3).

Consult the rest of this guide for additional information on total IPM Programs and download the MyIPM-SED app to learn more about disease/pest management and FRAC codes. Also consult the Diagnosis Tool (https://diagnosis.ces.ncsu.edu/strawberry/) and Strawberry Disease Factsheets (https://strawberries.ces.ncsu.edu/strawberries-diseases/) for additional information and assistance in identifying diseases.
<table>
<thead>
<tr>
<th>Decision Code</th>
<th>Fungicide Resistance Issue</th>
<th>Botrytis</th>
<th>Anthracnose</th>
<th>Sprays During Bloom and Fruit Ripening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>No resistance</td>
<td>No disease</td>
<td>12+9</td>
<td>7</td>
</tr>
<tr>
<td>B-1</td>
<td>No resistance</td>
<td>No resistance</td>
<td>captain+17</td>
<td>11+7</td>
</tr>
<tr>
<td>C-1</td>
<td>FRAC 7</td>
<td>No resistance</td>
<td>captain+17</td>
<td>captain+11</td>
</tr>
<tr>
<td>D-1</td>
<td>FRAC 17</td>
<td>No resistance</td>
<td>thiram+11</td>
<td>captain</td>
</tr>
<tr>
<td>E-1</td>
<td>FRAC 7+17</td>
<td>No resistance</td>
<td>thiram+11</td>
<td>captain</td>
</tr>
<tr>
<td>F-1</td>
<td>FRAC 12+9</td>
<td>No resistance</td>
<td>captain+17</td>
<td>11+7</td>
</tr>
<tr>
<td>G-1</td>
<td>FRAC 12+9+17</td>
<td>No resistance</td>
<td>thiram+11</td>
<td>captain</td>
</tr>
<tr>
<td>H-1</td>
<td>FRAC 12+9+7</td>
<td>No resistance</td>
<td>captain+17</td>
<td>captain</td>
</tr>
<tr>
<td>I-1</td>
<td>FRAC 12+9+7+17</td>
<td>No resistance</td>
<td>thiram+11</td>
<td>captain</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B-1</td>
</tr>
<tr>
<td></td>
<td>FRAC 11</td>
<td>captain+17</td>
<td>captain+7</td>
<td>12+9</td>
</tr>
<tr>
<td></td>
<td>FRAC 11</td>
<td>captain+17</td>
<td>captain</td>
<td>12+9</td>
</tr>
<tr>
<td></td>
<td>FRAC 11</td>
<td>captain+7</td>
<td>captain+7</td>
<td>12+9</td>
</tr>
<tr>
<td></td>
<td>FRAC 11</td>
<td>captain+17</td>
<td>captain+7</td>
<td>thiram</td>
</tr>
<tr>
<td></td>
<td>FRAC 11</td>
<td>captain+7</td>
<td>captain</td>
<td>thiram</td>
</tr>
<tr>
<td></td>
<td>FRAC 11</td>
<td>thiram+7</td>
<td>captain</td>
<td>thiram</td>
</tr>
<tr>
<td></td>
<td>FRAC 11</td>
<td>thiram+7</td>
<td>captain</td>
<td>thiram</td>
</tr>
<tr>
<td></td>
<td>FRAC 11</td>
<td>thiram+17</td>
<td>captain</td>
<td>thiram</td>
</tr>
<tr>
<td></td>
<td>FRAC 11</td>
<td>thiram+17</td>
<td>captain</td>
<td>thiram</td>
</tr>
</tbody>
</table>

**Decision Management Code Guidelines:**

A: Botrytis is expected with no resistance and plants are verified to be anthracnose free.
B-1 to I-1: The anthracnose pathogen is known to be sensitive to FRAC 11 products.
B-2 to I-2: The anthracnose pathogen is known to be resistant to FRAC 11 products.

**NOTE:** For B-1 to I-1: If anthracnose is known to be absent, then the FRAC 11 products are NOT needed.
B-1: Botrytis is expected, no resistance is documented, and plants are verified to harbor the anthracnose pathogen.
C-1: Botrytis is resistant to FRAC 7 products, and plants are verified to harbor the anthracnose pathogen.
<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness</th>
<th>REI</th>
<th>PHI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrytis fruit rot</td>
<td>*** SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>pentyiopyrad (Fontelis)</td>
<td>16 to 24 fl oz</td>
<td><strong>E</strong>&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 72 fl oz of product per acre per year. Some matted row cultivars may show phytotoxicity (see label). &lt;strong&gt;FRAC 7&lt;/strong&gt;.</td>
</tr>
<tr>
<td></td>
<td>isofetamid (Kenja 400SC)</td>
<td>13.5 to 15.5 fl oz</td>
<td><strong>E</strong>&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 3 applications of product at the high rate or more than 4 applications of product at the low rate per acre per year (54 fl oz per acre per year). Do not apply a third application of product within 28 days of the second application of the product. Some matted row cultivars may show phytotoxicity (see label). &lt;strong&gt;FRAC 7&lt;/strong&gt;.</td>
</tr>
<tr>
<td></td>
<td>fluopyram + pyrimethanil (Luna Tranquility)</td>
<td>16 to 27 fl oz</td>
<td><strong>E</strong>&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>1 day</td>
<td>Do not apply more than 54.7 fl oz of product per acre per year. Do not apply more than 0.446 lb of fluopyram per acre per year. Do not apply more than 2.1 lb of pyrimethanil per acre per year. &lt;strong&gt;Luna Tranquility is not registered for use in LA. FRAC 7 + 9.&lt;/strong&gt;</td>
</tr>
<tr>
<td></td>
<td>*** SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>fluopyram + trifloxystrobin (Luna Sensation)</td>
<td>6 to 7.6 fl oz</td>
<td><strong>E</strong>&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 day</td>
<td>Do not apply more than 27.1 fl oz of product per acre per year. Do not apply more than 0.446 lb of fluopyram per acre per year. Do not apply more than 0.6 lb of trifloxystrobin per acre per year. &lt;strong&gt;FRAC 7 + 11&lt;/strong&gt;.</td>
</tr>
<tr>
<td></td>
<td>cyprodinil + fludioxonil (Switch 62.5WG)</td>
<td>11 to 14 oz</td>
<td><strong>E</strong></td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 56 oz of product per acre per year. Do not apply more than 1.3 lb of cyprodinil per acre per year. Do not apply more than 0.9 lb of fludioxonil per acre per year. &lt;strong&gt;FRAC 9 + 12&lt;/strong&gt;.</td>
</tr>
<tr>
<td></td>
<td>fenhexamid (Elevate 50 WDG)</td>
<td>1.5 lb (stand-alone) 1.0 to 1.5 lb (tank mix)</td>
<td><strong>E</strong>&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not make more than 2 consecutive applications before switching to a fungicide with a different mode of action. Do not apply more than 6.0 lb of product per acre per season. Do not apply more than 3.0 lb of fenhexamid per acre per season. Under light pressure, 1.0 lb Elevate plus captan may be used (see label). With plastic mulch, do not apply within 16 ft of naturally vegetated or aquatic areas. &lt;strong&gt;Note: Due to resistance issues fenhexamid should be applied with a protectant, such as captan (FRAC M04). FRAC 17&lt;/strong&gt;.</td>
</tr>
<tr>
<td></td>
<td>*** SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Early Bloom (10%) and into Harvest: Disease Management

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness</th>
<th>REI</th>
<th>PHI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrytis fruit rot (cont’d)</td>
<td>pydiflumetofen + fludioxonil (Miravis Prime)</td>
<td>9.1 to 13.4 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not make more than 2 consecutive applications of product or of FRAC 7- or FRAC 12-containing products. Do not make more than 2 applications at the maximum application rate per year. Do not apply more than 26.8 fl oz of product per acre per year. Do not apply more than 0.268 lb of pydiflumetofen per acre per year. Do not apply more than 0.9 lb of fludioxonil per acre per year. The minimum application interval is 7 days. See label for additions use restrictions. FRAC 7 + 12.</td>
</tr>
<tr>
<td></td>
<td>thiram (Thiram SC)</td>
<td>2.0 – 2.5 qt</td>
<td>G</td>
<td>24 hr</td>
<td>1 day</td>
<td>Thiram is a broad-spectrum fungicide similar to captan. Do not apply more than 5 applications (12.4 qt product) per year west of the Mississippi River or more than 12 applications per year (29.7 qt product) east of the Mississippi River. See label for active ingredient limits per acre per year and for other restrictions. FRAC M03.</td>
</tr>
<tr>
<td></td>
<td>captan (various)</td>
<td>See labels</td>
<td>G</td>
<td>24 hr</td>
<td>1 day</td>
<td>See product labels for product and/or active ingredient season limits. FRAC M04.</td>
</tr>
<tr>
<td>pyrimethanil (Scala SC)</td>
<td>18 fl oz (alone) 9-18 fl oz (tank mix)</td>
<td>G^R</td>
<td>12 hr</td>
<td>1 day</td>
<td></td>
<td>Do not apply more than 54 fl oz of product per acre per crop. See label for additional use restrictions. FRAC 9.</td>
</tr>
<tr>
<td>polyoxin D zinc salt Ph-D (OSO 5%SC)</td>
<td>6.2 oz 6.5 to 13 fl oz</td>
<td>G</td>
<td>4 hr</td>
<td>0 days</td>
<td>0 days</td>
<td>OSO 5%SC is OMRI-listed. Ph-D: Do not apply more than 6 applications of products containing any polyoxin as the active ingredient per season. See label for additional restrictions regarding season limits. OSO: Do not apply more than 6 applications at the maximum rate per acre per season. See label for additional restrictions regarding season limits. FRAC 19.</td>
</tr>
</tbody>
</table>

***SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***
<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness</th>
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<th>PHI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrytis fruit rot AND anthracnose fruit rot</td>
<td><strong>pyraclostrobin + boscalid (Pristine)</strong></td>
<td>18.5 to 23 oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt; (anthracnose) G&lt;sup&gt;G&lt;/sup&gt; (Botrytis)</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 115 oz of product per acre per year. Do not apply more than 5 applications at the maximum rate per year. <strong>FRAC 11 + 7.</strong>*</td>
</tr>
<tr>
<td></td>
<td><strong>fluopyram + trifloxystrobin (Luna Sensation)</strong></td>
<td>6 to 7.6 fl oz</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 27.1 fl oz of product per acre per year. Do not apply more than 0.446 lb of fluopyram per acre per year. Do not apply more than 0.6 lb of trifloxystrobin per acre per year. <strong>FRAC 7 + 11.</strong>*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>fluxapyroxad + pyraclostrobin (Merivon)</strong></td>
<td>8 to 11 fl oz</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 3 applications of product per season. Do not apply more than 33 fl oz of product per acre per year. <strong>FRAC 7 + 11.</strong>*</td>
<td></td>
</tr>
<tr>
<td>pydiflumetofen + fludioxonil (Miravis Prime)</td>
<td>11.4 to 13.4 fl oz</td>
<td>E (Botrytis) G (anthracnose)</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not make more than 2 consecutive applications of product or of FRAC 7- or FRAC 12-containing products. Do not make more than 2 applications at the maximum application rate per year. Do not apply more than 26.8 fl oz of product per acre per year. Do not apply more than 0.268 lb of pydiflumetofen per acre per year. Do not apply more than 0.9 lb of fludioxonil per acre per year. The minimum application interval is 7 days. See label for additions use restrictions. <strong>FRAC 7 + 12.</strong>*</td>
<td></td>
</tr>
<tr>
<td>difenoconazole + cyprodinil (Inspire Super)</td>
<td>16.0 to 20.0 fl oz</td>
<td>VG (Botrytis) G (anthracnose)</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 80 fl oz of Inspire Super per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.3 lb of cyprodinil per acre per year. <strong>FRAC 3 + 9.</strong>*</td>
<td></td>
</tr>
<tr>
<td>captan (various)</td>
<td>See labels</td>
<td>G</td>
<td>24 hr</td>
<td>1 day</td>
<td>For better control and resistance management, use captan plus thiophanate-methyl (see label). See product labels for product and/or active ingredient season limits. <strong>FRAC M04.</strong>*</td>
<td></td>
</tr>
</tbody>
</table>

**Note: Products in this section are labeled for both Botrytis and anthracnose.**

***SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***
### Early Bloom (10%) and into Harvest: Disease Management

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
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<th>PHI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracnose fruit rot</td>
<td>Pristine, Merivon, or Cabrio show the best efficacy against AFR under high anthracnose pressure in research studies and either can be used if there is no resistance to FRAC 11 fungicides. Switch 62.5WG also has decent anthracnose control. If weather conditions (warm &amp; wet) favor AFR or you start to approach the upper limit of FRAC 11 fungicides allowed (4 to 5 applications), consider rotating to a tank-mix of captan + Tilt.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>azoxystrobin (Abound)</td>
<td>6.0 to 15.5 fl oz See labels</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>4 hr</td>
<td>0 days</td>
<td>See labels</td>
<td>Do not apply more than 60 fl oz of Abound per acre per year. Do not apply more than 1.0 lb azoxystrobin per acre per year. See other product labels for product specific limits. In recent research, Abound and similar products have performed less well than Cabrio/Pristine. <strong>FRAC 11.</strong></td>
</tr>
<tr>
<td>fluopyram + trifloxystrobin</td>
<td>4.0 to 7.6 fl oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>See labels</td>
<td>Do not apply more than 27.1 fl oz of product per acre per year. Do not apply more than 0.446 lb of fluopyram per acre per year. Do not apply more than 0.6 lb of trifloxystrobin per acre per year. <strong>FRAC 7 + 11.</strong></td>
</tr>
<tr>
<td>fluxapyroxad + pyraclostrobin</td>
<td>5.5 to 8 fl oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>See labels</td>
<td>Do not apply more than 3 applications of product per season. Do not apply more than 33 fl oz of product per acre per year. <strong>FRAC 7 + 11.</strong></td>
</tr>
<tr>
<td>pyraclostrobin + boscalid</td>
<td>18.5 to 23 oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>See labels</td>
<td>Do not apply more than 115 oz of product per acre per year. Do not apply more than 5 applications at the maximum rate per year. <strong>FRAC 11 + 7.</strong></td>
</tr>
<tr>
<td>pyraclostrobin (Cabrio EG)</td>
<td>12 to 14 oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>See labels</td>
<td>Do not apply more than 70 oz of product per acre per season. Do not apply more than 0.875 lb of pyraclostrobin per acre per season. <strong>FRAC 11.</strong></td>
</tr>
<tr>
<td>trifloxystrobin (Flint Extra)</td>
<td>2.5 to 3.0 fl oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>See labels</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 18 fl oz of product per acre per year. <strong>FRAC 11.</strong></td>
</tr>
<tr>
<td>azoxystrobin + difenoconazole</td>
<td>12 to 14 fl oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>See labels</td>
<td>Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. <strong>FRAC 11 + 3.</strong></td>
</tr>
</tbody>
</table>

***SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***
<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness</th>
<th>REI</th>
<th>PHI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracnose fruit rot (cont’d)</td>
<td><strong>azoxystrobin + propiconazole (Quilt Xcel)</strong></td>
<td>14 fl oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.45 lb of propiconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. Do not make more than 4 applications of Quilt Xcel per year. <strong>FRAC 11 + 3.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>difenoconazole + cyprodinil (Inspire Super)</strong></td>
<td>16.0 to 20.0 fl oz</td>
<td>G</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 80 fl oz of Inspire Super per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.3 lb of cyprodinil per acre per year. <strong>FRAC 3 + 9.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>captan (various)</strong></td>
<td>See labels</td>
<td>G</td>
<td>24 hr</td>
<td>1 day</td>
<td>In plantings known to be infected with the anthracnose crown rot pathogen, consider applying captan plus thiophanate-methyl at 10- to 14-day intervals, for a total of 2 to 3 applications in the fall. See product labels for product and/or active ingredient season limits. <strong>FRAC M04.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>cyprodinil + fludioxonil (Switch 62.5WG)</strong></td>
<td>11 to 14 oz</td>
<td>G</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 56 oz of product per acre per year. Do not apply more than 1.3 lb of cyprodinil per acre per year. Do not apply more than 0.9 lb of fludioxonil per acre per year. <strong>FRAC 9 + 12.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>pydiflumetofen + fludioxonil (Miravis Prime)</strong></td>
<td>11.4 to 13.4 fl oz</td>
<td>G</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not make more than 2 consecutive applications of product or of FRAC 7- or FRAC 12-containing products. Do not make more than 2 applications at the maximum application rate per year. Do not apply more than 26.8 fl oz of product per acre per year. Do not apply more than 0.268 lb of pydiflumetofen per acre per year. Do not apply more than 0.9 lb of fludioxonil per acre per year. The minimum application interval is 7 days. See label for additional use restrictions. <strong>FRAC 7 + 12.</strong></td>
</tr>
</tbody>
</table>

***SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***
### Early Bloom (10%) and into Harvest: Disease Management

<table>
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<tr>
<th>Pest/Problem</th>
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</table>
| Anthracnose fruit rot (cont’d) | propiconazole (Tilt)  
[other products available] | 4 fl oz  
See labels | F | 24 hr  
See labels | 0 days  
See labels | No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 16 fl oz of Tilt per acre per year. Do not apply more than 4 applications of Tilt per year. Do not apply more than 0.45 lb of propiconazole per acre per year. See other product labels for product-specific limits. **FRAC 3.** |
| Anthracnose crown rot | difenoconazole + cyprodinil (Inspire Super) | 16.0 to 20.0 fl oz | G | 12 hr | 0 days | No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 80 fl oz of Inspire Super per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.3 lb of cyprodinil per acre per year. **FRAC 3 + 9.** |
| Captain (various) | See labels | G | 24 hr | 1 day | In plantings known to be infected with the anthracnose crown rot pathogen, consider applying captain plus thiophanate-methyl at 10- to 14-day intervals, for a total of 2 to 3 applications in the fall. See product labels for product and/or active ingredient season limits. **FRAC M04.** |
| Thiophanate-methyl (Topsin M WSB)  
[other products available] | 0.75 to 1 lb  
See labels | G<sup>2</sup> | 24 hr  
See labels | 1 day  
See labels | **For suppression only.** Do not apply more than 4 lb of product per acre per year. Do not apply more than 2.8 lb thiophanate-methyl per acre per year. **FRAC 1.** |
| Azoxystrobin + difenoconazole (Quadris Top) | 12 to 14 fl oz | G<sup>2</sup> | 12 hr | 0 days | No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. **FRAC 11 + 3.** |

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## Early Bloom (10%) and into Harvest: Disease Management

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<tbody>
<tr>
<td>Anthracnose crown rot (cont’d)</td>
<td>thiophanate-methyl + propiconazole (Protocol)</td>
<td>1.33 pt</td>
<td>G</td>
<td>24 hr</td>
<td>1 day</td>
<td>Do not apply more than 5.3 pt of product per acre per season. Do not apply more than 0.45 lb of propiconazole per acre per season. Do not apply more than 2.8 lb thiophanate-methyl per acre per season. No more than 2 applications should be made per season for resistance management. <strong>FRAC 1 + 3.</strong></td>
</tr>
<tr>
<td></td>
<td>pydiflumetofen + fludioxonil (Miravis Prime)</td>
<td>11.4 to 13.4 fl oz</td>
<td>G</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not make more than 2 consecutive applications of product or of FRAC 7- or FRAC 12-containing products. Do not make more than 2 applications at the maximum application rate per year. Do not apply more than 26.8 fl oz of product per acre per year. Do not apply more than 0.268 lb of pydiflumetofen per acre per year. Do not apply more than 0.9 lb of fludioxonil per acre per year. The minimum application interval is 7 days. See label for additional use restrictions. <strong>FRAC 7 + 12.</strong></td>
</tr>
<tr>
<td>Powdery mildew only</td>
<td>triflumizole (Procure 480SC)</td>
<td>4 to 8 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>1 day</td>
<td>Check label for prohibited rotational crops. Do not plant leafy or fruiting vegetables within 30 days after application. Do not plant bulb or root vegetables within 60 days after application. Do not plant cotton, small cereal grains, and all other crops not registered within one year of application. Do not apply more than 4 applications of product per crop per year. Do not apply more than 32 fl oz of product per acre per season. <strong>FRAC 3.</strong></td>
</tr>
<tr>
<td></td>
<td>myclobutanil (Rally 40WSP)</td>
<td>2.5 to 5 oz</td>
<td>E</td>
<td>24 hr</td>
<td>1 day</td>
<td>Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 oz of product per acre per year. <strong>FRAC 3.</strong></td>
</tr>
<tr>
<td></td>
<td>flutriafol (Rhyme)</td>
<td>5 to 7 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>Rhyme is registered for control of powdery mildew and for drip application to manage charcoal rot. Do not apply more than 4 applications per year. Do not apply more than 28 fl oz of product per acre per year. <strong>FRAC 3.</strong></td>
</tr>
<tr>
<td></td>
<td>quinoxyfen (Quintec)</td>
<td>4 to 6 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>1 day</td>
<td>Do not use more than 4 times per crop and no more than 2 times in a row before switching to a product with a different mode of action. Rotate with other mildewcides. Do not apply more than 24 fl oz of product per acre per crop. See label for additional restrictions. <strong>FRAC 13.</strong></td>
</tr>
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<tr>
<td><strong>Powdery mildew only (cont’d)</strong></td>
<td>flutianil (Gatten)</td>
<td>6.0 to 8.0 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not apply more than 5 applications per year. Do not apply more than 0.132 lb flutianil per acre per year. Crop can be harvested after product has dried. <strong>Gatten is not registered for use in all states; check state registration status prior to use. FRAC U13.</strong></td>
</tr>
<tr>
<td></td>
<td>difenoconazole + cyprodinil (Inspire Super)</td>
<td>16.0 to 20.0 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 80 fl oz of Inspire Super per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.3 lb of cyprodinil per acre per year. <strong>FRAC 3 + 9.</strong></td>
</tr>
<tr>
<td></td>
<td>cyflufenamid (Torino)</td>
<td>3.4 oz</td>
<td>VG</td>
<td>4 hr</td>
<td>0 days</td>
<td>Do not make more than 2 applications per year. Do not apply more than 6.8 oz of product per acre per calendar year. Do not apply more than once every 14 days. <strong>FRAC U06.</strong></td>
</tr>
</tbody>
</table>
| **Powdery mildew AND anthracnose fruit rot** | azoxystrobin (Abound) [*other products available*] | 6.0 to 15.5 fl oz  
*See labels* | E* | 4 hr  
*See labels* | 0 days  
*See labels* | Do not apply more than 60 fl oz of Abound per acre per year. Do not apply more than 1.0 lb azoxystrobin per acre per year. See other product labels for product specific limits. **FRAC 11.** |
| | pyraclostrobin + boscalid (Pristine) | 18.5 to 23 oz | E* | 12 hr | 0 days | Do not apply more than 115 oz of product per acre per year. Do not apply more than 5 applications at the maximum rate per year. **FRAC 11 + 7.** |
| | fluopyram + trifloxystrobin (Luna Sensation) | 4.0 to 7.6 fl oz | E* | 12 hr | 0 days | Do not apply more than 27.1 fl oz of product per acre per year. Do not apply more than 0.446 lb of fluopyram per acre per year. Do not apply more than 0.6 lb of trifloxystrobin per acre per year. **FRAC 7 + 11.** |
| **Powdery mildew AND anthracnose fruit rot** | pyraclostrobin (Cabrio EG) | 12 to 14 oz | E* | 12 hr | 0 days | Do not apply more than 70 oz of product per acre per season. Do not apply more than 0.875 lb of pyraclostrobin per acre per season. **FRAC 11.** |
| | azoxystrobin + difenoconazole (Quadris Top) | 12 to 14 fl oz | E* | 12 hr | 0 days | Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. **FRAC 11 + 3.** |

**SEE RESISTANCE MANAGEMENT RECOMMENDATIONS ON PAGES 27 AND 43.***
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</thead>
<tbody>
<tr>
<td>Powder mildew AND anthracnose fruit rot (cont’d)</td>
<td>azoxystrobin + propiconazole (Quilt Xcel)</td>
<td>14 fl oz</td>
<td>E&lt;sup&gt;R&lt;/sup&gt;</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.45 lb of propiconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. Do not make more than 4 applications of Quilt Xcel per year. <strong>FRAC 11 + 3.</strong></td>
</tr>
<tr>
<td></td>
<td>difenoconazole + cyprodinil (Inspire Super)</td>
<td>16.0 to 20.0 fl oz</td>
<td>E (powdery mildew) G (anthracnose)</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 80 fl oz of Inspire Super per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.3 lb of cyprodinil per acre per year. <strong>FRAC 3 + 9.</strong></td>
</tr>
<tr>
<td></td>
<td>pydiflumetofen + fludioxonil (Miravis Prime)</td>
<td>11.4 to 13.4 fl oz</td>
<td>E (powdery mildew) G (anthracnose)</td>
<td>12 hr</td>
<td>0 days</td>
<td>Do not make more than 2 consecutive applications of product or of FRAC 7- or FRAC 12-containing products. Do not make more than 2 applications at the maximum application rate per year. Do not apply more than 26.8 fl oz of product per acre per year. Do not apply more than 0.268 lb of pydiflumetofen per acre per year. Do not apply more than 0.9 lb of fludioxonil per acre per year. The minimum application interval is 7 days. See label for additional use restrictions. <strong>FRAC 7 + 12.</strong></td>
</tr>
<tr>
<td>propiconazole (Tilt) [other products available]</td>
<td>4 fl oz</td>
<td>VGR (powdery mildew) F (anthracnose)</td>
<td>24 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Not registered for anthracnose crown rot control. Do not apply more than 16 fl oz of Tilt per acre per year. Do not apply more than 4 applications of Tilt per year. Do not apply more than 0.45 lb of propiconazole per acre per year. See other product labels for product specific limits. <strong>FRAC 3.</strong></td>
<td></td>
</tr>
</tbody>
</table>
## Early Bloom (10%) and into Harvest: Disease Management

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<tbody>
<tr>
<td>Common leaf spot, leaf scorch, leaf blight (e.g., Mycosphaerella, Phomopsis, Gnomonia)</td>
<td>See <a href="#">New Leaf Growth to Pre-bloom: Disease Management</a> recommendations. Fungicide applications for anthracnose and Botrytis fruit rot are typically sufficient for management of these foliar diseases.</td>
<td></td>
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</tbody>
</table>
## Harvest: Arthropod Management

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<tbody>
<tr>
<td>Aphids</td>
<td>See <a href="#">Pre-bloom to Harvest: Arthropod Management</a> recommendations.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Leaf rolling caterpillars</td>
<td>Leaf rolling caterpillars are rarely pests in southeastern strawberries and should only be treated if feeding or webbing is on or near fruit.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>chlorantraniliprole (Coragen)</td>
<td></td>
<td>3.5 to 7.5 fl oz</td>
<td>E</td>
<td>4 hr</td>
<td>1 day</td>
<td>IRAC 28.</td>
</tr>
<tr>
<td>spinosad (Entrust 80W) (Entrust SC)</td>
<td></td>
<td>1.25 to 2 oz 4 to 6 fl oz</td>
<td>E</td>
<td>4 hr</td>
<td>1 day</td>
<td>IRAC 5. Rotate to a different class of insect control products after 2 successive applications of spinosad. See product labels for season limits and additional restrictions. Entrust is <a href="#">OMRI-listed</a>.</td>
</tr>
<tr>
<td>methoxyfenozide (Intrepid)</td>
<td></td>
<td>6 to 12 fl oz</td>
<td>VG</td>
<td>4 hr</td>
<td>3 days</td>
<td>IRAC 18.</td>
</tr>
<tr>
<td><em>Bacillus thuringiensis</em> (Bt) (many products)</td>
<td>See labels</td>
<td></td>
<td>G</td>
<td></td>
<td></td>
<td>Many Bt formulations are <a href="#">OMRI-listed</a>. Bt insecticides have a short residual. Heavy infestations may need repeated applications. Applications are more effective against young larvae. IRAC 11B2.</td>
</tr>
<tr>
<td>Sap beetles</td>
<td>Cultural controls</td>
<td>N/A</td>
<td>important</td>
<td>N/A</td>
<td>N/A</td>
<td>Regular, thorough harvest will help minimize sap beetle populations. Sap beetles are attracted to the odor of overripe fruit, so keeping fruit picked clean will reduce problems. Sap beetles can also be attracted away from fields using bucket traps baited with overripe fruit or wheat bread dough. Bait bucket lures and culled strawberries must be disposed of either off site or buried. Insecticide treatments should only be used if thorough harvest is not possible (i.e., pick-your-own operations or inclement weather). IRAC 11B2.</td>
</tr>
<tr>
<td>Slugs and snails</td>
<td>See <a href="#">Pre-bloom to Harvest: Arthropod Management</a> recommendations.</td>
<td></td>
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</tr>
<tr>
<td>Tarnished plant bug</td>
<td>Tarnished plant bugs vary in their economic significance throughout the Southeast. Check with local Cooperative Extension personnel to determine if treatment is necessary. If tarnished plant bugs are present, the treatment threshold is generally very low.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>novaluron (Rimon 0.83 EC)</td>
<td></td>
<td>12 fl oz</td>
<td>E</td>
<td>12 hr</td>
<td>1 day</td>
<td>Allow 7 days between applications. DO NOT apply more than 36 fl oz/acre per season. The use of adjuvants or surfactants is prohibited. IRAC 15. Note: Rimon 0.83 EC is not labeled for use against tarnished plant bugs in strawberry. However, the use patterns for labeled pests are consistent with tarnished plant bug control. IRAC 15.</td>
</tr>
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### Harvest: Arthropod Management

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<tr>
<td>Tarnished plant bug (cont’d)</td>
<td>bifenthrin (Brigade 10 WSB)</td>
<td>6.4 to 32 oz</td>
<td>G</td>
<td>12 hr</td>
<td>0 days</td>
<td>The use of broad-spectrum insecticides during bloom will damage honey bee populations. DO NOT apply when bees are foraging. Refer to label. <strong>IRAC 3A.</strong></td>
</tr>
<tr>
<td></td>
<td>fenpropathrin (Danitol 2.4 EC)</td>
<td>10.67 fl oz</td>
<td>G</td>
<td>24 hr</td>
<td>2 days</td>
<td>DO NOT make more than 2 applications. DO NOT apply when bees are foraging. <strong>Note:</strong> Danitol 2.4 DC is not labeled for use against tarnished plant bugs in strawberry. However, the use patterns for labeled pests are consistent with tarnished plant bug control. <strong>IRAC 3A.</strong></td>
</tr>
<tr>
<td>Spotted-wing drosophila</td>
<td>Spotted-wing drosophila (SWD) larvae have been found in both fall and spring fruiting strawberries in the southeast, but SWD populations are highest during fall. Traps may be useful in determining if SWD treatments are necessary in spring fruiting strawberries. Check with local extension personnel for recommended monitoring methods. Preventative management is strongly recommended in fall fruit strawberries. If SWD is active during strawberry harvest, treat at least weekly and reapply treatments in the event of rain. <strong>Materials effective against SWD are toxic to bees.</strong> Apply SWD treatments in the evening or night, when bees are not actively foraging.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>bifenthrin (Brigade 10 WSB)</td>
<td>6.4 to 32 oz</td>
<td>E</td>
<td>12 hr</td>
<td>0 days</td>
<td>The use of broad-spectrum insecticides during bloom will damage honey bee populations. DO NOT apply when bees are foraging. Refer to label. <strong>IRAC 3A.</strong></td>
</tr>
<tr>
<td></td>
<td>spinetoram (Radiant SC)</td>
<td>6 to 10 fl oz</td>
<td>E</td>
<td>4 hr</td>
<td>1 day</td>
<td><strong>IRAC 5.</strong></td>
</tr>
<tr>
<td></td>
<td>fenpropathrin (Danitol 2.4 EC)</td>
<td>16 fl oz</td>
<td>VG</td>
<td>24 hr</td>
<td>3 days</td>
<td>DO NOT make more than 2 applications. DO NOT apply when bees are foraging. <strong>IRAC 3A.</strong></td>
</tr>
<tr>
<td></td>
<td>malathion (Malathion 57 EC)</td>
<td>1.5 to 3 pt</td>
<td>G</td>
<td>12 hr</td>
<td>3 days</td>
<td>DO NOT apply when bees are foraging. DO NOT apply more than 3.2 pts in a single application and DO NOT make more than 4 applications per season. The minimum retreatment interval is 7 days. Higher rates may be needed for SWD control. <strong>IRAC 1B.</strong> <strong>Note:</strong> No malathion-containing products currently labeled in strawberries have SWD on the label. However, the use patterns for labeled pests are consistent with SWD control.</td>
</tr>
<tr>
<td></td>
<td>spinosad (Entrust 80W)</td>
<td>1.25 to 2 oz</td>
<td>G</td>
<td>4 hr</td>
<td>1 day</td>
<td>If organic SWD management is needed, be careful not to use Entrust for other pests as there are limited applications per season. Rotate to a different class of insect control products after 2 successive applications of spinosad. See product labels for season limits and additional restrictions. Entrust is OMRI-listed. <strong>IRAC 5.</strong></td>
</tr>
<tr>
<td></td>
<td>(Entrust SC)</td>
<td>4 to 6 fl oz</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Twospotted spider mite</td>
<td>Same as <strong>Post-Planting: Arthropod Management</strong> recommendations.</td>
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<tr>
<td>Whiteflies</td>
<td>Whiteflies are rare in open field production, but they can reach damaging densities in high tunnel or greenhouse production. Some materials cannot be used in greenhouses; check labels carefully.</td>
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<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>imidacloprid (Admire Pro)</td>
<td></td>
<td>1.3 fl oz (foliar)</td>
<td>VG</td>
<td>12 hr</td>
<td>7 days</td>
<td>DO NOT apply when bees are foraging. <strong>IRAC 4A</strong></td>
</tr>
<tr>
<td>novaluron (Rimon 0.83 EC)</td>
<td></td>
<td>12 fl oz</td>
<td>VG</td>
<td>12 hr</td>
<td>1 day</td>
<td>Allow 7 days between applications. DO NOT apply more than 36 fl oz/acre per season. The use of adjuvants or surfactants is prohibited. Rimon use is prohibited in greenhouses. <strong>Note: Rimon 0.83 EC is not labeled for use against whiteflies in strawberry. However, the use patterns for labeled pests are consistent with whitefly control. IRAC 15</strong></td>
</tr>
<tr>
<td>spiromesifen (Oberon 2 SC)</td>
<td></td>
<td>12 to 16 fl oz</td>
<td>VG</td>
<td>12 hr</td>
<td>3 days</td>
<td>Use only 3 applications per crop. Use in a minimum of 100 gal/acre. Oberon is also an effective miticide. The Oberon label does not prohibit use in greenhouses. <strong>IRAC 23.</strong></td>
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<tr>
<td>thiamethoxam (Actara)</td>
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<td>3 to 4 oz</td>
<td>G</td>
<td>12 hr</td>
<td>3 days</td>
<td>Do not apply more than 12 oz/acre Actara; allow 10 days between applications. DO NOT apply when bees are foraging; after an Actara application, WAIT FIVE DAYS before placing beehives into treated fields. Actara use is prohibited in greenhouses. <strong>IRAC 4A.</strong></td>
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</table>
Effectiveness of Various Chemicals for Strawberry Disease Management

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>FRAC Group</th>
<th>Angular leaf spot</th>
<th>Anthracnose crown rot (Gloeosporium)</th>
<th>Anthracnose fruit rot (Gloeosporium)</th>
<th>Botrytis crown rot</th>
<th>Botrytis fruit rot</th>
<th>Common leaf spot</th>
<th>Leaf blight</th>
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<th>Mucor fruit rot</th>
<th>Phytophthora crown and root rot</th>
<th>Pomonella rot</th>
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</table>

1 These ratings are benchmarks; actual performance will vary. Efficacy ratings do not necessarily indicate a labeled use for every disease.
2 Fungicides are sorted generally by FRAC group. Fungicides targeting oomycetes are listed together near the end of the table followed by plant activators and biofungicides.
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4 Certain fungicides, such as the QoI materials and Protocol, are registered and effective for powdery mildew, but are not recommended when only powdery mildew is present to avoid fungicide resistance selection in the anthracnose and Botrytis pathogens.
5 Phytotoxicity could occur.
6 Not effective if pathogen is resistant to the fungicide.
Effectiveness of Various Chemicals for Strawberry Disease Management (cont’d)\(^1\)

<table>
<thead>
<tr>
<th>Fungicide(^2)</th>
<th>FRAC Group</th>
<th>Angular leaf spot</th>
<th>Anthracnose crown rot (Gloeosporidium)</th>
<th>Anthracnose fruit rot (fumasonis)</th>
<th>Botrytis crown rot</th>
<th>Botrytis fruit rot</th>
<th>Common leaf spot</th>
<th>Leaf blight</th>
<th>Leather rot</th>
<th>Mucor fruit rot</th>
<th>Phytophthora crown and root rot</th>
<th>Powdery mildew(^4)</th>
<th>Red stele root rot</th>
<th>Rhizopus rot</th>
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<tbody>
<tr>
<td>azoxystrobin (Abound, others)</td>
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<td>NC</td>
<td>G(^b)</td>
<td>E(^b)</td>
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<td>F(^a)</td>
<td>F</td>
<td>NC</td>
<td>VG</td>
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<td>E(^b)</td>
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<td>F(^a)</td>
<td>F</td>
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<td>VG</td>
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<td>E(^b)</td>
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<td>E(^b)</td>
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</table>

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# Effectiveness of Various Chemicals for Strawberry Arthropod Management

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<tr>
<th>Insecticide/Molluscicide</th>
<th>IRAC Group</th>
<th>Imported fire ants</th>
<th>Aphids</th>
<th>Crickets</th>
<th>Cutworms</th>
<th>Cyclamen mites</th>
<th>Flower thrips</th>
<th>Leaf rolling caterpillars</th>
<th>Sap beetles</th>
<th>Slugs and snails</th>
<th>Spotted-wing drosophila</th>
<th>Strawberry clippers</th>
<th>Tarnished plant bugs</th>
<th>Twospotted spider mites</th>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>E</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td><em>Bacillus thuringiensis</em> (various)</td>
<td>11B2</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>E</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>bifenthrin (Brigade WSB)</td>
<td>3A</td>
<td>ND</td>
<td>G</td>
<td>ND</td>
<td>ND</td>
<td>F</td>
<td>VG</td>
<td>G</td>
<td>ND</td>
<td>ND</td>
<td>VG</td>
<td>VG</td>
<td>G</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>carbaryl (Sevin 4F, Sevin XLR)</td>
<td>1A</td>
<td>ND</td>
<td>ND</td>
<td>G</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>F</td>
<td>ND</td>
<td>G</td>
<td>VG</td>
<td>ND</td>
<td>ND</td>
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</tr>
<tr>
<td>chlorantraniliprole (Coragen)</td>
<td>28</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>E</td>
<td>ND</td>
<td>E</td>
<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td>cyflumetofen (Nealta)</td>
<td>25</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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</tr>
<tr>
<td>etoxazole (Zeal 72 WSP)</td>
<td>10B</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>fenpropathrin (Danitol 2.4 EC)</td>
<td>3A</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
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</tr>
<tr>
<td>fenpyroximate (Portal XLO)</td>
<td>21A</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>VG</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>flupyradifurone (Sivanto 200 SL)</td>
<td>4D</td>
<td>ND</td>
<td>VG</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>F</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>funbutatin-oxide (Vendex 50WP)</td>
<td>12B</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>P</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>hexythiazox (Savey 50 DF)</td>
<td>10A</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>horticultural oil (various)</td>
<td>UNE</td>
<td>ND</td>
<td>F</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>G</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>imidacloprid (Admire Pro)</td>
<td>4A</td>
<td>ND</td>
<td>VG</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>F</td>
<td>ND</td>
<td>VG</td>
<td></td>
</tr>
<tr>
<td>insecticidal soap (M-Pede)</td>
<td>--</td>
<td>ND</td>
<td>F</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>F</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>iron phosphate (Sluggo Snail and Slug Bait)</td>
<td>--</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>malathion (various)</td>
<td>1B</td>
<td>ND</td>
<td>F</td>
<td>F</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>metaldehyde (Deadline Bullets and MPs)</td>
<td>1B</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
</tbody>
</table>

1 These ratings are benchmarks; actual performance will vary. Efficacy ratings do not necessarily indicate a labeled use for every insect.

2 Insecticides are sorted in alphabetical order by the active ingredient.

3 Efficacy Ratings: The efficacy or importance of a management option is indicated by E = excellent, VG = very good, G = good, F = fair, P = poor, NC = no control, and ND = no data.
<table>
<thead>
<tr>
<th>Insecticide/Mollusicides²</th>
<th>IRAC Group</th>
<th>Imported fire ants</th>
<th>Aphids</th>
<th>Crickets</th>
<th>Cutworms</th>
<th>Cyclamen mites</th>
<th>Flower thrips</th>
<th>Leaf rolling caterpillars</th>
<th>Sap beetles</th>
<th>Slugs and snails</th>
<th>Spotted-wing drosophila</th>
<th>Strawberry clippers</th>
<th>Tarnished plant bugs</th>
<th>Twospotted spider mites</th>
<th>Whiteflies</th>
</tr>
</thead>
<tbody>
<tr>
<td>methoprene (Extinguish Professional Fire Ant Bait 0.5% B)</td>
<td>7A</td>
<td>VG</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>methoxyfenozide (Intrepid)</td>
<td>18</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>VG</td>
<td>ND</td>
<td>ND</td>
<td>VG</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>novaluron (Rimon 0.83 EC)</td>
<td>15</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>F</td>
<td>ND</td>
<td>G</td>
<td>F</td>
<td>E</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>E</td>
<td>ND</td>
<td>VG</td>
</tr>
<tr>
<td>predatory mites (various)</td>
<td>—</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>VG</td>
<td>ND</td>
</tr>
<tr>
<td>pyriproxyfen (Esteem Ant Bait 0.5% B)</td>
<td>7C</td>
<td>VG</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>rosemary &amp; peppermint oils (various)</td>
<td>UNE</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>F</td>
<td>ND</td>
</tr>
<tr>
<td>spinetoram (Radiant SC)</td>
<td>5</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>VG</td>
<td>ND</td>
<td>G</td>
<td>E</td>
<td>ND</td>
<td>ND</td>
<td>E</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>spinosad (Entrust 80W, Entrust SC)</td>
<td>5</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>G</td>
<td>VG</td>
<td>ND</td>
<td>ND</td>
<td>G</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td>spiromesifen (Oberson 2SC)</td>
<td>23</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>sucrose octanoate (SucraShield)</td>
<td>—</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>F</td>
<td>ND</td>
</tr>
<tr>
<td>thiamethoxam (Platinum, Actara)</td>
<td>4A</td>
<td>ND</td>
<td>G</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
</tbody>
</table>

¹ These ratings are benchmarks; actual performance will vary. Efficacy ratings do not necessarily indicate a labeled use for every insect.
² Insecticides are sorted in alphabetical order by the active ingredient.
³ Efficacy Ratings: The efficacy or importance of a management option is indicated by E = excellent, VG = very good, G = good, F = fair, P = poor, NC = no control, and ND = no data.
## Plasticulture Weed Control: Preplant

<table>
<thead>
<tr>
<th>Weed</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Crop Age Restrictions</th>
<th>REI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yellow nutsedge</strong>: Yellow nutsedge is a very difficult weed to control in strawberry grown on plastic mulch. It is able to penetrate plastic mulch soon after laying the mulch and prior to transplanting. The best control strategy is to use Spartan (a.i. sulfentrazone), which provides excellent control of yellow nutsedge and reduces tuber viability. There are no POST herbicides registered in strawberry that will control emerged yellow nutsedge. Refer to the product label for specific use information and contact your local county Extension agent if you have questions. Electronic product and supplemental labels are available in various online pesticide label databases and can be used to obtain more information before choosing an herbicide. These databases also often provide information regarding state registrations. See the General Pesticide Information section for a list of online databases.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow and purple nutsedge, annual broadleaf weeds, and annual grasses</td>
<td>Fumigation (See table on page 26.)</td>
<td>See labels</td>
<td>See labels</td>
<td>See labels</td>
<td>Annual grass and broadleaf weeds.</td>
</tr>
<tr>
<td>EPTC (Eptam 7E)</td>
<td>3.5 to 7 pt</td>
<td>Apply to soil surface at least 45 days before planting.</td>
<td>12 hr</td>
<td></td>
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</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>Annual broadleaf weeds, including Carolina geranium and cutleaf evening primrose</td>
<td>oxyfluorfen (Goal 2 XL)</td>
<td>up to 2 pt</td>
<td>Apply to soil surface of pre-formed beds at least 30 days before transplanting.</td>
<td>24 hr</td>
<td>Plastic mulch should be applied soon after Goal application. Best results occur when plastic is applied immediately after herbicide application. Incorporation is not necessary, but it may result in less crop injury. Soil disturbance after application will reduce weed control. MOA 14.</td>
</tr>
<tr>
<td>Annual broadleaf weeds</td>
<td>acifluorfen (Ultra Blazer 2 L)</td>
<td>0.5 to 1.5 pt</td>
<td>Apply banded application to row prior to laying plastic mulch and after final land preparation, and prior to transplanting.</td>
<td>48 hr</td>
<td>Crop row. Make one banded application before laying plastic mulch and after final land preparation, and prior to transplanting the crop. For best results, avoid soil disturbance during laying of plastic and planting of crop. MOA 14.</td>
</tr>
</tbody>
</table>
## Plasticulture Weed Control: Preplant

<table>
<thead>
<tr>
<th>Weed</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Crop Age Restrictions</th>
<th>REI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual broadleaf weeds including cutleaf evening primrose, henbit, chickweed, horseweed, pigweed species, wild radish and suppression of some annual grasses</td>
<td>flumioxazin (Chateau SW 51 WDG)</td>
<td>3 oz</td>
<td>Apply to soil surface of pre-formed beds at least 30 days before transplanting.</td>
<td>12 hr</td>
<td><strong>Crop row.</strong> Apply a minimum of 30 days prior to transplanting and prior to plastic mulch being laid. <strong>MOA 14.</strong></td>
</tr>
<tr>
<td>Broadleaf weeds including common chickweed, redroot and smooth pigweed, common lambsquarters and some annual grasses</td>
<td>napropamide (Devrinol and Devrinol 2-XT 2 EC) (Devrinol and Devrinol DF-XT 50 DF)</td>
<td>8 qt 8 lb</td>
<td>Apply to soil surface of pre-formed beds before laying plastic mulch.</td>
<td>24 hr</td>
<td>Devrinol applied to the bed before laying the plastic has potential to injure strawberry plants. For plant bed treatment preplant incorporate to weed-free soil before laying plastic mulch. Soil should be well worked yet moist enough to permit a thorough incorporation to a depth of 2 in. Incorporate within 24 to 72 hr (depending on formulation) of application before laying plastic mulch. If weed pressure is from small-seeded annuals, apply Devrinol to the surface of the bed immediately before laying the plastic mulch. If soil is dry, water or sprinkler irrigate with sufficient water to wet to a depth of 2 to 4 in. before laying the plastic mulch. Apply the plastic mulch over the treated soil within 24 to 72 hr. <strong>MOA 15.</strong></td>
</tr>
<tr>
<td>Yellow nutsedge, purple nutsedge, corn spurry, yellow woodsonrel, henbit, chickweed, suppression of curly dock</td>
<td>sulfentrazone (Spartan 4F)</td>
<td>4 to 8 oz (see label for soil restrictions)</td>
<td>Apply to soil surface of pre-formed beds.</td>
<td>12 hr</td>
<td>Rate is soil-type dependent. Use lower rate for coarse soils. Apply prior to planting and before weeds have emerged. Please refer to label for soil type restrictions. <strong>MOA 14.</strong></td>
</tr>
<tr>
<td>Weed</td>
<td>Management Options</td>
<td>Amount of Formulation per Acre</td>
<td>Crop Age Restrictions</td>
<td>REI</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------</td>
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<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Broadleaf weeds</td>
<td>clopyralid (Stinger 3 EC)</td>
<td>Crop row: 0.33 to 0.5 pt</td>
<td>Apply after strawberry plants are established and at least 30 days before harvest.</td>
<td>12 hr</td>
<td>The Stinger registration in strawberry is issued on a state-by-state basis; therefore, it may NOT be registered for use in all states. DO NOT apply within 30 days of harvest. DO NOT use a surfactant or apply in combination with other pesticides or crop injury may occur. DO NOT apply as a broadcast application. DO NOT compost treated vegetation if compost will be used on sensitive plants. MOA 4.</td>
</tr>
<tr>
<td>Annual and perennial grasses</td>
<td>clethodim (Arrow, Clethodim, Intensity, Select 2EC) (Intensity One, Select Max 1EC)</td>
<td>6 to 8 oz; 9 to 16 oz</td>
<td>Newly planted or established plantings</td>
<td>12 hr</td>
<td>Use high rate and sequential applications for perennial grasses (bermudagrass or johnsongrass). The addition of a nonionic surfactant at 0.25% v/v (1 qt per 100 gal of spray solution) or crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution) is required for optimum results. Do not apply within 4 days of harvest. With Select Max, add 0.25% nonionic surfactant (1 qt per 100 gal spray mix). MOA 1.</td>
</tr>
<tr>
<td>Annual and perennial grasses</td>
<td>sethoxydim (Poast 1.5 EC)</td>
<td>1 to 1.5 pt</td>
<td>Newly planted and established plantings</td>
<td>12 hr</td>
<td>Sequential applications will be necessary for perennial grass control. The addition of a nonionic surfactant (1 qt per 100 gal of water) or crop oil concentrate (1 gal per 100 gal of water) is necessary for optimum results. Do not apply within 7 days of harvest. Total use cannot exceed 2.5 pt per acre per year. MOA 1.</td>
</tr>
</tbody>
</table>
## Plasticulture Weed Control: Row Middles

<table>
<thead>
<tr>
<th>Weed</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Crop Age Restrictions</th>
<th>REI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small seeded annual broadleaf weeds including common chickweed, redroot and smooth pigweed, common lambsquarters and some annual grasses</td>
<td>napropamide (Devrinol DF-XT 50 DF, Devrinol 50 DF) (Devrinol 2-XT 2 EC)</td>
<td>8 lb 8 qt</td>
<td>Do not apply post-transplant if new foliage is exposed to spray.</td>
<td>24 hr</td>
<td>Apply as a banded preemergence treatment to the middles between plastic before weed emergence. Tank mixture with paraquat will provide preemergence and postemergence weed control. Rainfall or irrigation within 24 hr after Devrinol application is needed for optimum control. Effective on volunteer small grains (wheat, etc.) if applied before emergence. <strong>MOA 15.</strong></td>
</tr>
<tr>
<td>Annual grasses and small seeded broadleaf weeds</td>
<td>pendimethalin (Prowl H2O 3.8 EC)</td>
<td>1.5 pt</td>
<td>Do not apply post-transplant if new foliage is exposed to spray.</td>
<td>24 hr</td>
<td>Avoid contact with strawberry plant. See label for more information. PHI = 35 days. <strong>MOA 3.</strong></td>
</tr>
<tr>
<td>Annual broadleaf weeds</td>
<td>acifluorfen (Ultra Blazer 2 L)</td>
<td>0.5 to 1.5 pt</td>
<td>Apply with a shielded sprayer to middles between plastic.</td>
<td>48 hr</td>
<td><strong>DO NOT ALLOW ULTRA BLAZER TO CONTACT STRAWBERRY PLANTS.</strong> Apply as a direct-shielded application. <strong>MOA 14.</strong></td>
</tr>
<tr>
<td>Annual broadleaf weeds including cutleaf evening primrose, henbit, chickweed, horseweed, pigweed species, wild radish and suppression of some annual grasses</td>
<td>flumioxazin (Chateau SW 51 WDG)</td>
<td>3 oz</td>
<td>Apply with a hooded or shielded sprayer to middles between plastic.</td>
<td>12 hr</td>
<td>Apply for preemergence weed control in the middles. <strong>DO NOT APPLY AFTER FRUIT SET.</strong> Do not allow spray solution to come in contact with fruit or foliage. Spotting may occur. May kill or injure ryegrass in middles. <strong>MOA 14.</strong></td>
</tr>
<tr>
<td>Nonselective weed control</td>
<td>glyphosate (various formulations)</td>
<td>See labels</td>
<td>Apply with hooded sprayer or wiper applicator.</td>
<td>4 hr</td>
<td>To prevent SEVERE crop injury, use application equipment and technique that will prevent contact with any portion of the crop or plastic. Do not apply within 14 days of harvest. <strong>MOA 9.</strong></td>
</tr>
<tr>
<td></td>
<td>paraquat (Parazone 3 SL) (Gramoxone SL 2L)</td>
<td>1.3 pt 2 pt</td>
<td>Apply with hooded sprayer or shields to protect crop.</td>
<td>12 hr</td>
<td>Contact kill of all green foliage. Do not allow drift or spray solution to contact crop or severe injury or crop death will occur. The addition of a nonionic surfactant at 0.25 % v/v (1 pt per 50 gal of spay solution) is required for optimum results. Apply in a minimum spray volume of 20 gal per acre. Do not make more than 3 applications per year. <strong>MOA 22.</strong></td>
</tr>
<tr>
<td></td>
<td>pelargonic acid (Scythe 4 EC)</td>
<td>3 to 10% v/v</td>
<td>Apply with hooded or shielded sprayer for weed control in row middles.</td>
<td>12 hr</td>
<td>Product is a nonselective, contact herbicide with foliar activity. May be tank mixed with soil residual herbicides for extended weed control. Avoid contact with strawberry plant or severe injury will occur. <strong>MOA 27.</strong></td>
</tr>
<tr>
<td>Weed</td>
<td>Management Options</td>
<td>Amount of Formulation per Acre</td>
<td>Crop Age Restrictions</td>
<td>REI</td>
<td>Comments</td>
</tr>
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</tr>
<tr>
<td>Annual broadleaf weeds</td>
<td>carfentrazone (Aim 2 EC, Aim 1.9 EW)</td>
<td>up to 2 oz</td>
<td>Apply with hooded sprayer to middles between plastic.</td>
<td>12 hr</td>
<td>Apply post-directed using hooded sprayer for control of emerged weeds in row middles. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a crop oil concentrate at up to 1 gal per 100 gal solution or a nonionic surfactant at 2 pt per 100 gal of spray solution. Coverage is essential for good weed control. Does not control grass weeds. MOA 14.</td>
</tr>
</tbody>
</table>
### Matted Row Weed Control: Preplant

<table>
<thead>
<tr>
<th>Weed</th>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Crop Age Restrictions</th>
<th>REI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual grasses, broadleaf weeds, and yellow and purple nutsedge</td>
<td>Fumigation (See table on page 26.)</td>
<td>See labels</td>
<td>See labels</td>
<td>See labels</td>
<td>See labels for rates, plant-back intervals, and personal protective equipment requirements.</td>
</tr>
</tbody>
</table>

### Matted Row Weed Control: Preemergence

<table>
<thead>
<tr>
<th>Weed</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Annual grasses and small-seeded broadleaf weeds including common chickweed, field pansy</td>
<td>DCPA (Dacthal 6 L) (Dacthal 75-W)</td>
<td>8 to 12 pt, 8 to 12 lb</td>
<td>Newly planted and established plantings before bloom</td>
<td>12 hr</td>
<td>Apply the soil prior to planting. Can be preplant incorporated. Apply to established plantings in fall to early spring prior to first bloom. <strong>MOA 3.</strong></td>
</tr>
<tr>
<td>Annual grasses and small-seeded broadleaf weeds</td>
<td>napropamide (Devrinol, Devrinol 2-XT 2 EC) (Devrinol, Devrinol DF-XT 50 DF)</td>
<td>8 qt, 8 lb</td>
<td>Established strawberries</td>
<td>12 hr</td>
<td>Apply any time prior to weed emergence except for the interval between bloom and harvest. Rainfall or irrigation within 24 hr is needed for optimum weed control. See XT labels for information regarding delay in irrigation event. <strong>MOA 15.</strong></td>
</tr>
<tr>
<td>Annual broadleaf weeds and grasses including chickweed, henbit, annual pepperweed, Shepherd’s purse</td>
<td>terbacil (Sinbar 80 WDG)</td>
<td>See label</td>
<td>Newly planted and established plantings</td>
<td>12 hr</td>
<td>See label for soil type and organic matter content restrictions. For winter weed control, apply 2 to 6 oz per acre in late summer or early fall. If strawberry plants are not dormant, the application must be followed immediately by 0.5 to 1 in. of overhead irrigation or rainfall. For extended control through harvest the following year, apply 2 to 4 oz per acre prior to mulching in late fall. In established plantings, apply 4 to 8 oz post-harvest renovation before new growth begins in mid-summer. For extended weed control through harvest the following year, apply 4 to 8 oz per acre prior to mulching in late fall. Do not apply within 110 days of harvest. See label for more information. <strong>MOA 5.</strong></td>
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### Matted Row Weed Control: Preemergence

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<tbody>
<tr>
<td>Annual broadleaf weeds including yellow rocket, shepherd’s purse, Virginia pepperweed, common chickweed, common groundsel</td>
<td>acifluorfen (Ultra Blazer 2L)</td>
<td>0.5 to 1.5 pt</td>
<td>Apply after the last harvest or following bed renovation or when plants are dormant.</td>
<td>48 hr</td>
<td>Two applications can be made. Do not apply the last application within 120 days of strawberry harvest. MOA 14.</td>
</tr>
<tr>
<td>Annual broadleaf weeds</td>
<td>flumioxazin (Chateau SW 51 WDG)</td>
<td>3 oz</td>
<td>Apply with hooded or shielded sprayer to row middles.</td>
<td>12 hr</td>
<td>DO NOT spray over top of strawberries. Apply prior to weed emergence. Crop spotting may occur if spray contacts the crop. DO NOT apply after fruit set. MOA 14.</td>
</tr>
<tr>
<td>Yellow nutsedge, purple nutsedge, corn spurry, yellow woodsorrel, henbit, chickweed and other broadleaf weeds</td>
<td>sulfentrazone (Spartan 4F)</td>
<td>4 to 8 oz (see label for soil restrictions)</td>
<td>Preplant</td>
<td>12 hr</td>
<td>See label for soil type and organic matter content restrictions. Do not apply after the crop has been transplanted or serious injury may occur. MOA 14.</td>
</tr>
</tbody>
</table>

### Matted Row Weed Control: Postemergence

<table>
<thead>
<tr>
<th>Weed</th>
<th>Management Options</th>
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<th>REI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadleaf weeds including ragweed, clover, vetch, dock, cocklebur, dandelion, red sorrel, sowthistle, thistle, and nightshade</td>
<td>clopyralid (Stinger 3 EC)</td>
<td>0.33 to 0.67 pt</td>
<td>Newly planted and established plantings</td>
<td>12 hr</td>
<td>The Stinger registration in strawberry is issued on a state-by-state basis. Therefore, it may NOT be registered for use in all states using this guide. Apply in the spring before harvest or post-harvest. Do not apply within 30 days of harvest. Do not use a surfactant or apply in combination with other pesticides. MOA 4.</td>
</tr>
<tr>
<td>Broadleaf weeds</td>
<td>2, 4-D amine (2,4-D Amine 4 SL)</td>
<td>2 to 3 pt</td>
<td>Established plantings</td>
<td>48 hr</td>
<td>Apply to well-established strawberries after harvest and before runners form or when crop is dormant. Not more than two treatments per year. Do not apply during bud, flower, or fruit stage. Timing is very critical to avoid damage. Do not apply unless possible injury to the crop is acceptable. MOA 4.</td>
</tr>
<tr>
<td>Annual broadleaf weeds</td>
<td>pelargonic acid (Scythe 4 EC)</td>
<td>3 to 10% v/v</td>
<td>Apply as a directed or shielded spray.</td>
<td>12 hr</td>
<td>Product is nonselective, contact herbicide with foliar activity. May be tank mixed with soil residual herbicides for extended weed control. Avoid contact with strawberry plant or severe injury will occur. MOA 27.</td>
</tr>
<tr>
<td>Weed</td>
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<tr>
<td>Contact kill of all green foliage</td>
<td>paraquat</td>
<td>1.3 pt</td>
<td>Apply with hooded sprayer or shields to protect crop.</td>
<td>12 hr</td>
<td>Contact kill of all green foliage. Do not allow drift or spray solution to contact crop or severe injury or crop death will occur. The addition of a non-ionic surfactant at 0.25 % v/v (1 pt/50 gal. of spray solution) is required for optimum results. Apply in a minimum spray volume of 20 gal. per acre. Do not make more than 3 applications per year. MOA 22.</td>
</tr>
<tr>
<td>Annual and perennial grasses</td>
<td>clethodim</td>
<td>6 to 8 oz</td>
<td>Newly planted or established plantings</td>
<td>12 hr</td>
<td>Use high rate, 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) or crop oil concentrate at 1% v/v (1 gal per 100 gal. of spray solution) is required for optimum results. Do not apply within 4 days of harvest. With Select Max, add 0.25% non-ionic surfactant, 1 qt per 100 gal spray mix. MOA 1.</td>
</tr>
<tr>
<td></td>
<td>fluazifop</td>
<td>12 to 24 oz</td>
<td>Newly planted (non-bearing only)</td>
<td>12 hr</td>
<td>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 for optimum control. MOA 1.</td>
</tr>
<tr>
<td></td>
<td>sethoxydim</td>
<td>1 to 1.5 pt</td>
<td>Newly planted and established plantings</td>
<td>12 hr</td>
<td>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 for optimum results. Do not apply within 7 days of harvest. Total use cannot exceed 2.5 pt/acre. MOA 1.</td>
</tr>
</tbody>
</table>
Wildlife Damage Prevention

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. Wild turkeys are also a problem; often feeding from below and getting under protective netting.

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 (up to 1 mile or more) to feed, the further 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. Exclusion can easily fail if not installed correctly or installed at the wrong time.

Almost all birds are state and 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 min.
- 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).
**Birds (cont’d)**

**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 (plastic effigies) 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. Geese have been observed feeding directly under several scare eyes. Kites or silhouettes of hawks – attached to a short string and poles around the crop may have limited efficacy. The silhouette should “fly” easily in natural breeze or wind so that the movement stresses and disturbs the feeding birds. The inflatable man (aka. Tall man, sky man, air dancer, Tall Boy) has also been reported to work. The erratic, sudden movements make it harder for birds to get used to and, to increase the effectiveness, sound could be added.

**Chemical repellents**
Methyl anthranilate (MA) 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 regard 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 blueberry, 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 or already very high in some areas 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. Hunters should be encouraged to harvest does as opposed to bucks to have much of an impact on deer populations.
Deer (cont’d)

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.

Repellents
Both taste and smell repellents are available for use. Smell repellents include commercially available products or materials such as tankage, blood, putrified egg solids, and certain soaps. While these products may be effective in the short term, repellents will not provide long-term control and will not provide control when populations are high or alternate food sources are scarce. Repellents, such as biosolids (for example, Milorganite®), are also effective. All repellents are biodegradable and need to be applied regularly and after rain or irrigation. Some repellents are not labeled for use on products intended for human consumption (for example, repellents with rotten or “putrified” egg as the active ingredient). Please read product labels carefully and use products as instructed. Lethal control may be necessary to reduce deer populations to tolerable densities. Consult your state wildlife resource department for lethal control options.

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 in. 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-ft fence, generally 6 ft 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-ft high with the addition of 3 single strand wires for a total of 8 ft will reduce costs. Slant wire fence is another design - see paragraph below. Standard vertical fence with outriggers may be useful. Contact extension specialist for details on fence design.

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 in. above ground level (approximately at the height of a deer’s nose). 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 in. 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 ft 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.
**Deer (cont’d)**

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.

**Voles**

Voles cause problems in strawberry fields by feeding on the roots and crowns of plants and by chewing holes in irrigation tapes under the plastic cover of raised beds. There are no rodenticides labeled for use in strawberries. However, practices utilized in preparing fields for plasticulture strawberries should rid the area of any resident vole populations. Therefore, vole control for these fields needs to focus primarily on preventing reinfestation from adjacent areas. Habitat modification practices such as cleaning up nearby fencerows, ditch banks and hedgerows, along with frequent, close mowing of vegetation surrounding the fields, will discourage vole presence as a result of increased exposure to predators. Maintaining a barrier of very closely mowed vegetation around the perimeter is one option. Another option is to maintain a bare-soil perimeter around the fruit crop if that can be done without increasing erosion risks. Seasonal diskng or herbicide treatment can maintain bare-soil perimeter seasonally.

**Rabbits and Other Wildlife**

Rabbits can devastate crops and can occur in high densities. Some products are sold as rabbit repellent, but the efficiency is largely untested. Fencing, mesh, or chicken wire may be the most effective solution. Bury the fence 6-8 in. below ground and extend to a height of 2 ½ ft. Secure at 6- to 8-ft intervals with sturdy stakes (wood, metal, or fiberglass). Coyotes may take strawberries, and armadillos may dig up plants as they forage for insects, ants, earthworms, and other food items. Fencing will aid in control of numerous small wildlife pests. Lethal control may be necessary. Consult your state wildlife resource department for lethal control options. Trapping is difficult, especially for coyotes and armadillos.
DISEASE PHOTOS

Photos: (A, C, D, E) G. Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org; (B) R. A. Melanson, Mississippi State University Extension, Bugwood.org; (F) E. Sikora, Auburn University, Bugwood.org; (G) D. Ferrin, LSU AgCenter, Bugwood.org; (H, J) P. Bach, University of Kentucky Research and Education Center, Bugwood.org; (I) SCRI-Dundee, Scottish Crop Research Institute, Bugwood.org; (K) N. Peres, University of Florida – IFAS.

- Anthracnose Fruit Rot
- Anthracnose Fruit Rot
- Anthracnose Crown Rot
- Botrytis Fruit Rot
- Common Leaf Spot
- Angular Leaf Spot
- Angular Leaf Spot
- Leaf Scorch
- Red Stele
- Phomopsis Leaf Blight
- Powdery Mildew
INSECT PHOTOS

Photos: (A, B, C, D, E, F, G) H. Burrack, North Carolina State University; (I) J. W. Lotz, Florida Department of Agriculture and Consumer Services, Bugwood.org.
WEED PHOTOS

Photos: (A, B, C, D, I, J) K. Jennings, North Carolina State University; (E, G, H) K. Sims, North Carolina State University; (F) C. Veazie, North Carolina State University.