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## Apple Spray Program

**J. F. Walgenbach, Entomology Research and Extension, and K. S. Yoder, Research and Extension Tree Fruit Pathologist, Virginia Tech**

See Integrated Orchard Management Guide for Commercial Apples (AG-572) for more detailed information on apple disease and insect control. For a copy, contact Jim Walgenbach, 455 Research Drive, Mills River, NC 28759; jim_walgenbach@ncsu.edu. The guide is also available online at [http://entomology.ces.ncsu.edu/apple-pest-management](http://entomology.ces.ncsu.edu/apple-pest-management).

### Table 6-1. Apple Spray Program

<table>
<thead>
<tr>
<th>Number and Time of Application</th>
<th>Amount of Fungicide and Insecticide Per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green-Tip Spray</strong>&lt;br&gt;When buds show 0.25-inch new growth</td>
<td><strong>Fungicide:</strong> Apply dodine (Syflit 3.4 FL) 1.5 to 3.0 pints OR cyprodinil (Vanguard 75WG) 5 ounces OR kresoxim-methyl (Sovran 50WG) 4 ounces OR trifloxystrobin (Flint 50 WG) 2 ounces OR pyraclostrobin + bosalid (Pristine 38WG) 14.5 to 18.5 ounces OR myclobutanil (various brands) 40 WP 5 to 10 ounces + captan 50W 3 pounds OR mancozeb 75 DF 3 pounds OR mancozeb 4F 2.4 quarts or metiram (Polyram 80DF) 3 pounds OR triflumizole (Procure 50WS) 8 to 12 fluid ounces + captan 50 W 3 pounds OR mancozeb 75 DF 3 pounds or mancozeb 4F 2.4 quarts or metiram (Polyram 80DF) 3 pounds OR fenbuconazole (Indar 2 F) 8 fluid ounces + captan 50 W 3 pounds or mancozeb 75 DF 3 pounds or mancozeb 4F 2.4 quarts or metiram (Polyram 80DF) 3 pounds OR difenconazole + cyprodinil (Inspire Super 2.82 EW) 12 fluid ounces OR fluzapyrodax + pyraclostrobin (Merivon 4.18 SC) 4 to 5.5 fluid ounces OR fludioxonil + trifloxystrobin (Luna Sensation 500 SC) 4.0 to 5.8 fluid ounces OR fludioxonil + pyrimethanil (Luna Tranquilty 4.16 SC) 11.2 to 16 fluid ounces OR fenhexamid (Fontelis 1.67 SC) 1 to 2 fluid ounces + mancozeb 75 DF 3 pounds or 4F 2.4 quarts or metiram (Polyram 80DF) 3 pounds. <strong>Insecticide:</strong> Do not follow oil with sulfur or sulfur. Add a 1 quart chlorpyrifos (Lorsban 4EC) OR 4 ounces pyridaphos (Estheem 35 WP) OR 34.5 ounces buprofezin (Centaur 70WDG). For improved control of San Jose scale, add 1 quart pyraclostrobin (Altacor 35 WP) 14 ounces ferrophosphin (Danitol 2.4 EC) OR 2.75 ounces sulfophos (Closer 28C).</td>
</tr>
<tr>
<td><strong>Half-Inch Green Spray</strong>&lt;br&gt;One week after GREEN-TIP SPRAY</td>
<td><strong>Fungicide:</strong> Use same as GREEN-TIP SPRAY. <strong>Insecticide:</strong> If an insecticide was not applied at green tip, use one of the products listed above; otherwise no insecticide is needed.</td>
</tr>
<tr>
<td><strong>Tight Cluster Spray</strong>&lt;br&gt;One week after HALF-INCH GREEN SPRAY</td>
<td><strong>Fungicide:</strong> Use same fungicides as GREEN-TIP SPRAY, except cyprodinil (Vanguard), kresoxim-methyl (Sovran), and trifloxystrobin (Flint). Add a sterol-inhibiting fungicide OR sulfur 4 to 12 pounds for mildew control and mancozeb 75 DF 3 pounds OR 4 F 2.4 quarts for rust control when using dodine on rust-susceptible varieties. <strong>Insecticide:</strong> For rosy apple aphid, apply 5 ounces acetamiprid (Assail 30 SG). For rosy apple aphid and plant bugs, apply 4.4 ounces thiamethoxam (Actara 25 WP) OR 16 ounces ferrophosphin (Danitol 2.4 EC) OR 2.75 ounces sulfophos (Closer 28C).</td>
</tr>
<tr>
<td><strong>Pink Spray</strong>&lt;br&gt;When blossom buds are pink, stems extended</td>
<td><strong>Fungicide:</strong> Use same fungicides as TIGHT CLUSTER SPRAY. <strong>Insecticide:</strong> If an insecticide effective against rosy apple aphid and/or tarnished plant bug was not applied at tight cluster, apply one of the above materials.</td>
</tr>
<tr>
<td><strong>Bloom Spray</strong>&lt;br&gt;One week before PETAL-FALL SPRAY will be applied within 7 days of preceding spray</td>
<td><strong>Fungicide:</strong> Use same fungicide as TIGHT CLUSTER SPRAY. FOR FIRE BLIGHT CONTROL: Use streptomycin WP at 60 to 100 parts per million in sprays at 3 to 5-day intervals from the start to the end of bloom. <strong>Insecticide:</strong> DO NOT USE an insecticide at BLOOM SPRAY.</td>
</tr>
<tr>
<td><strong>Petal-Fall Spray</strong>&lt;br&gt;When most petals have fallen</td>
<td><strong>Fungicide:</strong> captan 50W 6 to 8 pounds OR captan 50W 3 pounds + mancozeb 75 DF 3 pounds or mancozeb 4F 2.4 quarts or metiram (Polyram 80DF) 3 pounds OR myclobutanil (various brands) 40 WP 5 to 10 ounces + triflumizole (Procure 50S) 8 to 12 fluid ounces or fenbuconazole (Indar 2F) 8 fluid ounces + mancozeb 75 DF 3 pounds or mancozeb 4F 2.4 quarts or metiram (Polyram 80DF) 3 pounds + captan 50 W 3 pounds OR kresoxim-methyl (Sovran 50WG) 4 ounces OR trifloxystrobin (Flint 50 WG) 2 ounces OR pyraclostrobin + bosalid (Pristine 38WG) 14.5 to 18.5 ounces OR fluzapyrodax + pyraclostrobin (Merivon 4.18 SC) 4 to 5.5 fluid ounces OR fludioxonil + trifloxystrobin (Luna Sensation 500 SC) 4.0 to 5.8 fluid ounces OR fludioxonil + pyrimethanil (Luna Tranquilty 4.16 SC) 11.2 to 16 fluid ounces OR fenhexamid (Fontelis 1.67 SC) 14 to 20 fluid ounces + mancozeb 75 DF 3 pounds or 4F 2.4 quarts or metiram (Polyram 80DF) 3 pounds. If used is alone, include mancozeb 75 DF 3 pounds OR 4F 2.4 quarts OR metiram (Polyram 80DF) 3 pounds. If used is alone, include mancozeb 75 DF 3 pounds OR 4F 2.4 quarts OR metiram (Polyram 80DF) 3 pounds. If used is alone, include mancozeb 75 DF 3 pounds OR 4F 2.4 quarts OR metiram (Polyram 80DF) 3 pounds. If used is alone, include mancozeb 75 DF 3 pounds OR 4F 2.4 quarts OR metiram (Polyram 80DF) 3 pounds. <strong>Insecticide:</strong> For plum curculio and Oriental fruit moth, apply 5 ounces indoxacarb (Atavant 35WD) OR 3 pounds phosmet (Imidan 70 WP) OR 4.5 ounces thiamethoxam (Actara 25 WP) OR 4 ounces clothianidin (Cloth 50 WDG). For preventive control of European red mite and leafminer, use 3 ounces abamectin (Agi-Mek 0.75C) PLUS 0.25% horticultural spray oil (not a superior-type oil). For rosy apple aphid control is needed, apply 2.8 ounces imidacloprid (Admire 4.6SC).</td>
</tr>
<tr>
<td><strong>First Cover Spray</strong>&lt;br&gt;8 to 10 days after PETAL-FALL SPRAY</td>
<td><strong>Fungicide:</strong> Refer to relative effectiveness table and AG-572 for appropriate fungicides for summer disease control. <strong>Insecticide:</strong> For codling moth, apply 3 ounces chlorantraniliprole (Altacor 35 WDG) OR 5 ounces spinetoram (Delegate 25 WDG). If preventative control of European red mite is desired but was not applied at petal fall, apply 4 ounces clofentezin (Apollo SC) OR 4 ounces heptozalos (Savey 50 DF) OR 3 ounces etoxazole (ZeaL 72WD).</td>
</tr>
<tr>
<td><strong>Second Cover Spray</strong>&lt;br&gt;10 to 14 days after FIRST COVER SPRAY</td>
<td><strong>Fungicide:</strong> Refer to relative effectiveness table and AG-572 for appropriate fungicides for summer disease control. <strong>Insecticide:</strong> Same as FIRST COVER SPRAY for control of codling moth.</td>
</tr>
<tr>
<td><strong>Third Cover Spray</strong>&lt;br&gt;10 to 14 days after SECOND COVER SPRAY</td>
<td><strong>Fungicide:</strong> Refer to relative effectiveness table and AG-572 for appropriate fungicides for summer disease control. <strong>Insecticide:</strong> For tufted apple bud moth, apply 12 ounces methoxyfenozide (Intrepid 2F) 3, 3 ounces chlorantraniliprole (Altacor 35 WDG) OR 5 ounces spinetoram (Delegate 25 WDG). On plantings susceptible to dogwood borer, apply 1 pound chlorpyrifos (Lorsban 4EC) OR 3 ounces acetamiprid microencapsulated (Altacor 25 WP) 14 ounces ferrophosphin (Danitol 2.4 EC) OR 2.75 ounces sulfophos (Closer 28C). In orchards with San Jose problems, apply 4 ounces pyridaphos (Estheem 35 WP) OR 34.5 ounces buprofezin (Centaur 70WDG).</td>
</tr>
<tr>
<td><strong>Summer Cover Sprays</strong>&lt;br&gt;10- to 14-day intervals or as pest density and weather conditions dictate</td>
<td><strong>Fungicide:</strong> Refer to relative effectiveness tables and AG-572 for appropriate fungicides for summer disease control. <strong>Insecticide:</strong> Refer to relative effectiveness tables and AG-572 for appropriate insecticides and miticides for summer insect control. For second generation codling moth sprays (mid to late July), do not use the same insecticide used for first generation control (first- and second cover sprays). Important sprays include codling moth in mid to late July. For apple maggot in late July. For apple maggot, apply 2.8 ounces imidacloprid (Admire Pro) OR 3 pounds phosmet (Imidan). In orchards not using mating disruption up to this point, apply 1.2 ounces/aere of Check OFM-F (sprayable pheromone for mating disruption) in mid to late July and again one month later for late-season oriental fruit moth control.</td>
</tr>
</tbody>
</table>

1. Do not follow oil with captan or sulfur for 14 days.

Further Information


*A Grower’s Guide to Apple Insects and Diseases in the Southeast. (http://ipm.ncsu.edu/apple/contents.html).*

Copies of these publications are available from your county Cooperative Extension center.
### Table 6-2. Relative Effectiveness of Various Fungicides for Apple Disease Control

<table>
<thead>
<tr>
<th>Fungicide and Rate of Usage Per Acre</th>
<th>FRAC Code</th>
<th>Days Between Last Spray and Harvest</th>
<th>Relative Control Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>captain (Captain 50W) 6 lb</td>
<td>M4</td>
<td>0</td>
<td>G P F F F F NC</td>
</tr>
<tr>
<td>captain (Captain 50W) 8 lb</td>
<td>M4</td>
<td>0</td>
<td>G-E P G G G NC</td>
</tr>
<tr>
<td>captain (Captain 50W) 4 lb +</td>
<td>M4</td>
<td>0</td>
<td>G P F F F F NC</td>
</tr>
<tr>
<td>ziram (Ziram 76DF) 4 lb +</td>
<td>M3</td>
<td>1</td>
<td>G F G-E G-E G G-E P-F</td>
</tr>
<tr>
<td>thiophanate methyl (various brands) 8 oz</td>
<td>M5</td>
<td>14</td>
<td>G F G-E G-E G G-E P-F</td>
</tr>
<tr>
<td>captain (Captain 80 WG) 3.75 lb +</td>
<td>M4</td>
<td>33</td>
<td>G-E P G G G G NC</td>
</tr>
<tr>
<td>potassium phosphite (ProPhyl 4.2 L) 2 to 3 qt</td>
<td>M3</td>
<td>0</td>
<td>G-E P G G G G NC</td>
</tr>
<tr>
<td>cyproconazole + cyproconazole (Inspire Super) 12 fl oz</td>
<td>3 + 9</td>
<td>14</td>
<td>E G-E NC NC NC NC NC NC</td>
</tr>
<tr>
<td>thionavazole + cyproconazole (Indar 2F) 8 fl oz</td>
<td>3</td>
<td>3</td>
<td>E G-E F F F F G</td>
</tr>
<tr>
<td>captain (Captain 50W) 3 lb or</td>
<td>M4</td>
<td>14</td>
<td>G-E E F-P F-P P-P F G</td>
</tr>
<tr>
<td>mancozeb 75 DF 3 lb or F 4.2 qt or</td>
<td>M3</td>
<td>77</td>
<td>E-E F-G P-F P-F F-E G</td>
</tr>
<tr>
<td>mancozeb (Polyram 80 DF) 3 lb</td>
<td>M3</td>
<td>77</td>
<td>E-E F-P F-P F-P F G</td>
</tr>
<tr>
<td>fluzinam (Omega 500F) 13.8 fl oz</td>
<td>29</td>
<td>28</td>
<td>F F ND F F F F P-F G</td>
</tr>
<tr>
<td>fluzinam + trifloxystrobin (Luna Sensation) 4.0 to 5.8 fl oz</td>
<td>7 + 11</td>
<td>14</td>
<td>E G G-E G G G-E E</td>
</tr>
<tr>
<td>fluzinam + pyrimethanil (Luna Tranquility) 11.2 to 16 fl oz</td>
<td>7 + 9</td>
<td>72</td>
<td>E F ND ND ND ND ND E</td>
</tr>
<tr>
<td>fluzinam + pyraclostrobin (Merivon) 4.4 to 5.5 fl oz</td>
<td>7 + 11</td>
<td>0</td>
<td>E G-E G-E G G G-E E</td>
</tr>
<tr>
<td>kresoxim-methyl (Sovran 50 WG) 4 to 6.4 oz</td>
<td>7</td>
<td>30</td>
<td>E-F G G-E G F G-E G</td>
</tr>
<tr>
<td>lime sulfur 2%</td>
<td>M2</td>
<td>0</td>
<td>G P ND ND ND ND P-F G</td>
</tr>
<tr>
<td>mancozeb 75 DF 3 lb or F 4.2 qt or</td>
<td>M3</td>
<td>77</td>
<td>E F-G F G-E G G G-E G</td>
</tr>
<tr>
<td>mancozeb (Polyram 80 DF) 6 lb</td>
<td>M3</td>
<td>Don't apply after petal fall</td>
<td>G G-E E F P-F P-F P-F P</td>
</tr>
<tr>
<td>mancozeb (Polyram 80 DF) 3 lb</td>
<td>M3</td>
<td>77</td>
<td>G-E E F-P F-P F-P F</td>
</tr>
<tr>
<td>myclobutanil (various brands) 5 to 10 oz</td>
<td>3</td>
<td>14</td>
<td>E-E E E E P-P E-E E</td>
</tr>
<tr>
<td>captain (Captain 50W) 3 lb or</td>
<td>M4</td>
<td>77</td>
<td>E-E F-G P-F P-F F-E G</td>
</tr>
<tr>
<td>mancozeb 75 DF or 3 lb or F 4.2 qt or</td>
<td>M3</td>
<td>77</td>
<td>E-E E F-P F-P F-P F</td>
</tr>
<tr>
<td>mancozeb (Polyram 80 DF) 3 lb</td>
<td>M3</td>
<td>77</td>
<td>E-E E F-P F-P F-P F</td>
</tr>
<tr>
<td>penhiopryd (Fontesis 1.67 SC) 14 to 20 fl oz</td>
<td>7</td>
<td>77</td>
<td>E G-E F-G F F F G</td>
</tr>
<tr>
<td>mancozeb 75 DF 3 lb or F 4.2 qt or</td>
<td>M3</td>
<td>77</td>
<td>E-G-E F-G F F F G</td>
</tr>
<tr>
<td>mancozeb (Polyram 80 DF) 3 lb</td>
<td>M3</td>
<td>77</td>
<td>E-G-E F-G F F F G</td>
</tr>
<tr>
<td>pyraclostrobin + bosalid (Pristine 38 WG) 14.4 to 18.4 oz</td>
<td>11 + 7</td>
<td>0</td>
<td>E-F-G G-E G G G-E G</td>
</tr>
<tr>
<td>pyrimethanil (Scala 5 SC) 7 to 10 fl oz</td>
<td>17</td>
<td>72</td>
<td>G-E NC NC NC NC NC NC</td>
</tr>
<tr>
<td>sulfur (wettable) 4 to 12 lb</td>
<td>M2</td>
<td>0</td>
<td>P P NC NC NC NC P G</td>
</tr>
<tr>
<td>tebuconazole (Tebuzol 45 DF) 4 to 8 oz +</td>
<td>3</td>
<td>75</td>
<td>G-E G-E G F G P P E</td>
</tr>
<tr>
<td>captain (Captain 50W) 3 lb or</td>
<td>M4</td>
<td>75</td>
<td>G-E G-E G F G P P E</td>
</tr>
<tr>
<td>mancozeb 75 DF 3 lb or F 4.2 qt or</td>
<td>M3</td>
<td>77</td>
<td>E-E F-G P-F F G G-E</td>
</tr>
<tr>
<td>mancozeb (Polyram 80 DF) 3 lb</td>
<td>M3</td>
<td>77</td>
<td>E-E F G G-P-F F G G-E</td>
</tr>
<tr>
<td>thiophanate methyl (various brands) 8 to 12 oz</td>
<td>1</td>
<td>0</td>
<td>G P G G P G-E P-F</td>
</tr>
<tr>
<td>thiophanate methyl (various brands) 8 to 12 oz +</td>
<td>1</td>
<td>0</td>
<td>G P G G P G-E P-F</td>
</tr>
<tr>
<td>captain (Captain 50 W) 6 lb or</td>
<td>M4</td>
<td>0</td>
<td>G-E P E G F G-E P-F</td>
</tr>
<tr>
<td>captain (Captain 50 W) 8 lb</td>
<td>M4</td>
<td>0</td>
<td>G-E P E G-E F-G F G-E</td>
</tr>
<tr>
<td>trifloxystrobin (Flint 50 WG) 2 to 3 oz</td>
<td>11</td>
<td>14</td>
<td>E-F G G-E G G G-E G</td>
</tr>
<tr>
<td>trifloxystrobin (Procure 50 WS) 8 to 12 fl oz</td>
<td>3</td>
<td>14</td>
<td>E-F-G G-E G G G-E G</td>
</tr>
<tr>
<td>mancozeb 75 DF 3 lb or F 4.2 qt or</td>
<td>M3</td>
<td>77</td>
<td>E-G-E F-G P-F P-F F-G</td>
</tr>
<tr>
<td>mancozeb (Polyram 80 DF) 3 lb</td>
<td>M3</td>
<td>77</td>
<td>E-G-E F P P-F F G</td>
</tr>
<tr>
<td>ziram (Ziram 76 DF) 6 lb</td>
<td>M3</td>
<td>14</td>
<td>F G G G F G-E P</td>
</tr>
</tbody>
</table>

1. Use higher rate when the likelihood of disease is high.
2. Combine Ziram with Tопsin-M 70W at 8 to 12 ounces per acre to improve white rot, black rot, sooty blotch, and flyspeck control.
3. Thiophanate methyl is not recommended for scab control in North Carolina because of scab resistance.
### Table 6-3A. Relative Effectiveness of Various Insecticides for Apple Insect and Mite Control

<table>
<thead>
<tr>
<th>Insecticide, Brand Name, and Amount per Acre</th>
<th>IRAC MOA Group</th>
<th>Days Between Last Spray and Harvest</th>
<th>San Jose Scale</th>
<th>European Red Mite</th>
<th>Two-Spotted Spider Mite</th>
<th>Rosy Apple Aphid</th>
<th>Green Apple Spirea Aphids</th>
<th>White Apple Leaftopper</th>
<th>Codling MOTH</th>
<th>Taeniolella Leathemata</th>
<th>Redbud Leathemata</th>
<th>Oriental Fruit moth</th>
</tr>
</thead>
<tbody>
<tr>
<td>abamectin (Agri-Mek 0.75SC) 3.0 oz</td>
<td>6</td>
<td>28</td>
<td>NC</td>
<td>E</td>
<td>E</td>
<td>NC</td>
<td>NC</td>
<td>G</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>acetamiprid (Assail 30 SG) 4.0 oz</td>
<td>4A</td>
<td>7</td>
<td>P</td>
<td>NC</td>
<td>NC</td>
<td>E</td>
<td>E</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>B. thuringiensis (various brands) 1 lb</td>
<td>11</td>
<td>0</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>P</td>
<td>G</td>
<td>G</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>bifenthrin (Centaur 70WDP) 34.5 oz</td>
<td>UN</td>
<td>7</td>
<td>E</td>
<td>NC</td>
<td>E</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>carbaryl (Sevin XLR) 4 pt</td>
<td>1A</td>
<td>1</td>
<td>P</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>E</td>
<td>P</td>
<td>G</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>chlorantraniliprole (Altascor 35WG) 3 oz</td>
<td>28</td>
<td>14</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>chlorpyrifos (Lorsban 50W) 3 lb</td>
<td>1B</td>
<td>&gt;100</td>
<td>E</td>
<td>NC</td>
<td>NC</td>
<td>G</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>clothianidin (Belay 2.13 SC) 6 oz</td>
<td>4A</td>
<td>7</td>
<td>ND</td>
<td>NC</td>
<td>NC</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>cyhalothrin (Proaxis 0.5EC) 3 oz</td>
<td>1B</td>
<td>21</td>
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1 Use prebloom only.
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<tr>
<th>Insecticide, Brand Name, and Amount per Acre</th>
<th>IRAC MOA Group</th>
<th>Days Between Last Spray and Harvest</th>
<th>Spotted Tentiform Leafminer</th>
<th>Tentiform Plant Bug</th>
<th>Stink Bugs</th>
<th>Apple Maggot</th>
<th>Plum Curculio</th>
<th>Japanese Beetle</th>
<th>Woolly Apple Aphis</th>
<th>Predators²</th>
<th>Slétrorus punctum (Lady Beetle)</th>
<th>Amblyseius fallacis (Mite)</th>
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<tr>
<td>abamectin (Agri-Mek 0.75C) 3.0 oz</td>
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<td>acetamiprid (Assail 30 SG) 5 oz</td>
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<td>imidacloprid (Admire Pro) 2.8 oz</td>
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<td>permethrin (Ambush 2E) 8 oz</td>
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<td>NC</td>
<td>NC</td>
<td>G</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>sulfoxaflur (Closer 25C)</td>
<td>4C</td>
<td>7</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>G</td>
<td>P</td>
<td>ND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>thiacloprid (Calypso 4F) 4 oz</td>
<td>4A</td>
<td>30</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>E</td>
<td>G</td>
<td>P</td>
<td>E</td>
<td>P</td>
<td>E</td>
<td>G</td>
</tr>
<tr>
<td>thiacloprid (Calypso 4F) 4 oz</td>
<td>4A</td>
<td>35</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>E</td>
<td>G</td>
<td>P</td>
<td>E</td>
<td>P</td>
<td>E</td>
<td>G</td>
</tr>
</tbody>
</table>

¹ Use prebloom only.

² Ratings for beneficial arthropods are based on toxicity to the organism; i.e., E implies excellent toxicity to the beneficial and will result in elimination of the natural enemy from an orchard. NC implies no control or toxicity and will result in preservation of the beneficial in an orchard.
Blueberry Management Program

H. J. Burrack, Entomology Extension and Research; and W. O. Cline, Plant Pathology Extension

The Insecticide Resistance Action Committee (IRAC) groups insecticides and the Fungicide Resistance Action Committee (FRAC) groups fungicides into mode of action (MOA) categories. These categories are listed following the pesticide and formulation names. To reduce the risk of resistance development, avoid successive applications of products with the same MOA. Organically acceptable insecticides (OMRI listed) are indicated in Precautions and Remarks.

Insecticides should only be applied if the pest of concern is present in economically damaging levels. If insect injury does not result in greater loss than the cost of treatment, treatment is not justified. Therefore, some degree of insect presence should be tolerated and insecticides should not be applied on a scheduled basis as may be appropriate for fungicides. Note that insecticides listed are acceptable for use on fruit to be marketed in the United States. If fruit is to be exported, check with purchasers to ensure that the materials you intend to use are acceptable for use on fruit in their target markets.

Fungicides are mainly protectants, and are usually applied prior to the appearance of disease symptoms, based on past history of the particular disease threat on a given cultivar, location and plant growth stage. Not all diseases are present on every farm. To avoid applying fungicides unnecessarily, learn to identify diseases by their symptoms, and keep records of those that occur on your farm.

Many pesticides have brand name and generic formulations. Where this is the case, information is either provided for one of the most common formulations, or if there is no clear consensus on the most common formulation, “many formulations” are indicated.

Table 6-4. Blueberry Management Program

<table>
<thead>
<tr>
<th>Season Pest</th>
<th>Insecticide, Mode of Action Code, and Formulation</th>
<th>Amount of Formulation Per Acre</th>
<th>Restricted Entry Interval (REI) (hours)</th>
<th>Pre harvest Interval (PHI) (Days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dormant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scale insects</td>
<td>Oil superior-type, IRAC Unknown</td>
<td>1 to 3% vol/vol</td>
<td>4</td>
<td>0</td>
<td>Oil may be applied dormant or delayed dormant. Apply as needed for scale infestations. Reduce to 1% rate just before bloom. Do not apply oil when temperatures are expected to be higher than 65 degrees F or lower than 30 degrees F within 24 hours. Do not use within 14 days of lime-sulfur or Captan. Use 200 to 400 gallons water per acre with at least 200 pounds of pressure. Some oils are OMRI listed; check labels.</td>
</tr>
<tr>
<td>Gall midge</td>
<td>Blueberry gall midge</td>
<td>1.25 to 2 oz</td>
<td>4</td>
<td>3</td>
<td>Entrust is OMRI listed</td>
</tr>
<tr>
<td>Gall midge</td>
<td>Spinetoram (IRAC 5) (Delegate)</td>
<td>3 to 6 oz</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diazinon (IRAC 1) (Diazinon AG500)</td>
<td>1 pt per 100 gal water</td>
<td>5 days</td>
<td>7</td>
<td>Only one foliar application is allowed per year.</td>
</tr>
<tr>
<td><strong>Delayed Dormant</strong></td>
<td>Calcium polysulfide (FRAC M2) (Lime-Sulfur solution)</td>
<td>5 gal per acre in 50-70 gal of total spray volume</td>
<td>48</td>
<td>—</td>
<td>Apply at delayed dormant 1-2 weeks before leaf and/or flower buds begin to break. Exobasidium is not specifically on the label. However, when applied for Promopris, suppression of Exobasidium has been observed. <strong>DANGER</strong> – calcium polysulfide products are caustic and can cause injury. Calcium polysulfide products are also corrosive to metals and may permanently discolor or stain non-metal sprayer parts. Do not mix lime-sulfur solutions with acids or phosphate fertilizer products because deadly and potentially extremely flammable hydrogen sulfide gas may be emitted.</td>
</tr>
<tr>
<td></td>
<td>Calcium polysulfide (FRAC M2) (Sulfornix)</td>
<td>1 gal per acre in sufficient water for coverage</td>
<td>48</td>
<td>—</td>
<td>Do not apply lime-sulfur or Sulfornix within 14 days of an oil spray. Do not apply when air temperatures are above 85 degrees F. As a precaution, do not apply within 14 days of a Dormex spray.</td>
</tr>
<tr>
<td><strong>Pre-Bloom Sprays</strong> - Green-tip on vegetative and flower buds</td>
<td>Twibligh</td>
<td>Fenbuconazole (FRAC 3) (Indar 75 WP)</td>
<td>2 oz</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Mummy berry</td>
<td></td>
<td>6 fl oz</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pyraclostrobin + boscalid (FRAC 11+7) (Pristine 38 W)</td>
<td>18.5 to 23 oz</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Propiconazole (FRAC 3) (Orbit 3.6E, Tilt 3.6E, Bumper 41.6EC, Propimax EC)</td>
<td>6 fl oz</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metconazole (FRAC 3) (Quash 50 WDG)</td>
<td>2.5 oz</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Azoxystrobin + propiconazole (FRAC 3+11) (Quilt Xcel)</td>
<td>14 to 21 fl oz</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>Exobasidium</td>
<td>The fungus Exobasidium causes green-to-pink spots on fruit that do not ripen normally, and spots on leaves that are light green above and white below. Affected berries are unsightly and not marketable. Fungicides applied for other diseases may provide some control. The disease is most severe in shaded areas with dense foliage and poor ventilation. For images of this disease, see: <a href="http://incblueberryjournal.blogspot.com/2011/07/exobasidium-fruit-and-leaf-spot.html">http://incblueberryjournal.blogspot.com/2011/07/exobasidium-fruit-and-leaf-spot.html</a></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Pre-Bloom Sprays - Green-tip on vegetative and flower buds (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thrips</td>
<td>Thrips rarely require treatment in southern high bush blueberries in North Carolina but can reach damaging levels in rabbiteye blueberries. Thrips present in densities greater than 2 per flower in open rabbiteye blooms may justify treatment. Begin sampling bloom clusters for thrips at Stage 3. Sample 2 to 3 times a week from Stage 3 up to bloom. A minimum of 10 flower clusters per acre should be observed and either placed in a closed plastic bag at room temperature or shaken onto a white sheet of paper.</td>
<td>spinosad (IRAC 5) (Entrust)</td>
<td>1.25 to 2 oz</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>spinetoram (IRAC 5) (Delegate)</td>
<td>3 to 6 oz</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Bloom Treatments - 10% to 20% bloom</td>
<td>Pesticides can harm pollinating insects, so if pesticide applications are necessary during bloom, they should be made in the evening when bees are not foraging and to allow for the longest amount of dry time possible. See Table 5-1A. Relative Toxicity of Pesticides to Honey Bees for more information on specific active ingredients effects on bees.</td>
<td>Twig blight</td>
<td>Same as Pre-Bloom Sprays</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mummy berry</td>
<td>Same as Pre-Bloom Sprays</td>
<td>If mummy berry disease pressure is high this year or in previous years, apply fungicides every 7 to 10 days from budbreak through bloom. Foliar sprays using 25 to 50 gallons per acre are most effective.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flower blight</td>
<td>Anticipate flower blight caused by the fungus Botrytis cinerea when excessive rain occurs during bloom, or following a freeze event that injures blossoms.</td>
<td>Fenhexamid FRAC 17 (Elevate 50 WDG)</td>
<td>1.5 lb</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>cyprodinil + fluoxastrobin (FRAC 9+12) (Switch 62.5 WG)</td>
<td>11 to 14 oz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>captan (FRAC M4) (Captan 50 WP)</td>
<td>4 lb</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>captan (FRAC M4) (Captec 4L)</td>
<td>2 qt</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>captan + fenhexamid (FRAC M4+ 17) (CaptEvate 68 WG)</td>
<td>3.5 to 4.7 lb</td>
</tr>
<tr>
<td>Bloom Treatments - Full bloom</td>
<td>Mummy berry</td>
<td>Same as PRE-BLOOM SPRAYS</td>
<td>Note that Indar should not be used alone at full bloom or between bloom and harvest. Tank mix with Captan, Captec, or Ziram.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fruitrots</td>
<td>Same as Bloom Treatments</td>
<td>Fruit rot treatments should be applied 7 to 10 days apart.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thrips</td>
<td>Same as Pre-Bloom Treatments</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plum curculio</td>
<td>Plum curculio is an infrequent pest of North Carolina blueberries. Petal fall treatments of the materials below will be effective against both plum curculio and fruithoppers.</td>
<td>bifenthrin (IRAC 3) (Brigade) W3B</td>
<td>16 oz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>chlorantraniliprole (IRAC 28) (Altacor)</td>
<td>3.0 to 4.5 oz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>esfenvalerate (IRAC 3A) (Asana XL 0.66EC)</td>
<td>9.6 fl oz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>zeta cypermethrin + bifenthrin (IRAC 3) (Hero)</td>
<td>4 to 10.3 fl oz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kaolin clay (IRAC unknown) (Surround) WP</td>
<td>25 to 50 lb</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cranberry fruitworm</td>
<td>Fruitworm adults can be monitored with pheromone traps, and fruit should be observed for egg laying or evidence of tunnelling. Treatments for fruitworms are most effective when timed to egg hatch, as larvae feed inside fruit.</td>
<td>carbaryl (IRAC 1A) (Sevin) XLR</td>
<td>1.5 to 2 qt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cherry fruitworm</td>
<td></td>
<td>chlorantraniliprole (IRAC 28) (Altacor)</td>
<td>3.0 to 4.5 oz</td>
</tr>
</tbody>
</table>
### Table 6-4. Blueberry Management Program

<table>
<thead>
<tr>
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<th>Insecticide, Mode of Action Code, and Formulation</th>
<th>Amount of Formulation Per Acre</th>
<th>Restricted Entry Interval (REI) (hours)</th>
<th>Pre harvest Interval (PHI) (Days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petal Fall Treatments - Immediately after Bloom (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cranberry Fruitworm</td>
<td>indoxacarib (IRAC 22) (Avant)</td>
<td>3.5 to 6.0 oz</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Cherry Fruitworm (continued)</td>
<td>acetamiprid (IRAC 4A) (Assail) 30 SG</td>
<td>4.5 to 5.3 oz</td>
<td>12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spinosad (IRAC 5) (Entrust)</td>
<td>1.25 to 2 oz</td>
<td>4</td>
<td>3</td>
<td>Entrust is OMRI listed</td>
</tr>
<tr>
<td></td>
<td>spinetoram (IRAC 5) (Delegate) WG</td>
<td>3 to 5 oz</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>esfenvalerate, (IRAC 3A) (Asana XL) 0.66 EC</td>
<td>4.8 to 9.6 oz</td>
<td>12</td>
<td>14</td>
<td>Note that there are residue concerns for some IRAC Group 3A materials on fruit intended for export.</td>
</tr>
<tr>
<td></td>
<td>indoxacarib (IRAC 22A) (Avant)</td>
<td>3.5 to 6 oz</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>methoxyfenozide (IRAC 18) (Intrepid) 2F</td>
<td>10 to 16 fl oz</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>novaluron (IRAC 15) (Rimon) 0.83 EC</td>
<td>20 to 30 fl oz</td>
<td>12</td>
<td>8</td>
<td>Rimon is not labeled for cherry fruitworm.</td>
</tr>
<tr>
<td></td>
<td>pyriproxfen (IRAC 7) (Knack)</td>
<td>16 fl oz</td>
<td>12</td>
<td>7</td>
<td>Knack is an insect growth regulator and application must be timed carefully to egg hatch.</td>
</tr>
<tr>
<td></td>
<td>tetramethrin (IRAC 18) (Confirm) 2F</td>
<td>16 fl oz</td>
<td>12</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Leaf spots</td>
<td>fenbuconazole (FRAC 3) (Indar 75 WP) (Indar 2F)</td>
<td>2 oz</td>
<td>6 fl oz</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>pyridostrobin + boscalid (FRAC 11+7) (Pristine 38 W)</td>
<td>18.5 to 23 oz</td>
<td>12</td>
<td>0</td>
<td>Do not make more than two sequential applications with any combination of strobilurin fungicides (Abound or Pristine) before alternation with a fungicide that has a different mode of action (Captan, Ziram, Switch). Do not make more than four applications of strobilurin fungicides per season.</td>
</tr>
<tr>
<td></td>
<td>propiconazole (FRAC 3) (Orbit 3.6E, Tel 3.6E, Banner 41.6 EC, Propimax EC)</td>
<td>6 fl oz</td>
<td>12</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>metconazole (FRAC 3) (Quash 50 WDG)</td>
<td>2.5 oz</td>
<td>12</td>
<td>7</td>
<td>May be applied by ground (min. 20 gpa) or air (min 10 gpa). Do not apply more than twice in a row, or more than 7.5 ounces per season, or more than three times per season. Supplemental label for bushberries.</td>
</tr>
<tr>
<td></td>
<td>azoxystrobin + propiconazole (FRAC 3+11) (Quirt Xcel)</td>
<td>14 to 21 fl oz</td>
<td>12</td>
<td>30</td>
<td>Do not apply more than 82 fluid ounces per acre per season. Quilt Xcel may be applied by ground or air (minimum of 15 gpa).</td>
</tr>
<tr>
<td>Fruit Ripening through Harvest</td>
<td>Spotted wing drosophila</td>
<td>Spotted wing drosophila (SWD) females lay eggs in ripening and ripe soft skinned fruits, and larvae develop internally. Materials listed are likely to be effective against SWD based on current data. WD treatments should begin when fruit start to ripen and continue weekly through the end of harvest. Rotate IRAC groups between successive sprays. Some management tools used for blueberry maggot are effective against SWD, and management of blueberry maggot and SWD should be integrated as much as feasible.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenthrin (IRAC 3A) (Brigade WSB)</td>
<td>5.3 to 16.0 oz</td>
<td>12</td>
<td>1</td>
<td>Residue tolerances not established for all export destinations. Check with purchasers before incorporating this material in SWD management programs. No more than 5 applications of Brigade can be made per season. Note that there are residue concerns for some IRAC Group 3A materials on fruit intended for export.</td>
</tr>
<tr>
<td></td>
<td>cyrantraniliprole (IRAC 28) (Exirel)</td>
<td>13.5 to 20.5 fl oz</td>
<td>12</td>
<td>3</td>
<td>Minimum number of days between treatments is five. Do not apply a total of more than 0.4 pound ai/A of CYAZYPYR® or cyrantraniliprole containing products per year.</td>
</tr>
<tr>
<td></td>
<td>fenpropathrin (IRAC 3A) (Danitol 2.4 EC)</td>
<td>10.33 to 16 fl oz</td>
<td>24</td>
<td>3</td>
<td>No more than 2 applications of Danitol can be made per season.</td>
</tr>
<tr>
<td></td>
<td>malathion, (IRAC 1B) (Malathion) 8F</td>
<td>2.5 pt</td>
<td>12</td>
<td>1</td>
<td>There are several malathion formulations. No more than 2 applications of Malathion 8F can be made per year. No more than 5 pounds of malathion active ingredient from any source can be applied per acre per year. Use caution if this is the material of choice for multiple insect pests!</td>
</tr>
<tr>
<td></td>
<td>(Malathion) ULV</td>
<td>10 fl oz</td>
<td>12</td>
<td>1</td>
<td>No more than 5 applications of Malathion ULV can be made per year. No more than 5 pounds of malathion active ingredient from any source can be applied per acre per year. Use caution if this is the material of choice for multiple insect pests.</td>
</tr>
<tr>
<td></td>
<td>methomyl (IRAC 1A) (Lannate)</td>
<td>12 to 24 fl oz</td>
<td>48</td>
<td>3</td>
<td>No more than 4 applications of Lannate can be made per year.</td>
</tr>
<tr>
<td></td>
<td>phosmet (IRAC 1B) (Imidan)</td>
<td>1.33 lb</td>
<td>24</td>
<td>3</td>
<td>No more than 5 applications of Imidan can be made per year.</td>
</tr>
<tr>
<td></td>
<td>pyrinthrin (IRAC 3) (Pyganic 1.4 EC)</td>
<td>16 to 64 fl oz</td>
<td>12</td>
<td>0</td>
<td>Pyganic is OMRI listed, but appear to have limited residual activity.</td>
</tr>
<tr>
<td></td>
<td>spinosad (IRAC 5) (Entrust)</td>
<td>1.25 to 2 fl oz</td>
<td>4</td>
<td>0</td>
<td>Entrust is OMRI listed. Cover sprays of Entrust are not as persistent as other materials. No more than 9 ounces of Entrust can be applied per acre per year.</td>
</tr>
<tr>
<td></td>
<td>spinetoram (IRAC 5) (Delegate)</td>
<td>3 to 6 oz</td>
<td>4</td>
<td>3</td>
<td>No more than 19.5 ounces of Delegate can be applied per acre per year.</td>
</tr>
<tr>
<td></td>
<td>zeta cypermethrin (IRAC 3) (Mustang Max)</td>
<td>4 fl oz</td>
<td>12</td>
<td>1</td>
<td>Residue tolerances not established for all export destinations. Check with purchasers before incorporating this material in SWD management programs. No more than 6 applications of Mustang Max can be made per year. Note that there are residue concerns for some IRAC Group 3A materials on fruit intended for export.</td>
</tr>
</tbody>
</table>

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Table 6-4. Blueberry Management Program

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<tr>
<td>Fruit Ripening through Harvest (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spotted wing dirosophila (continued)</td>
<td>zeta cypermethrin + bifenthrin (IRAC 3) (Hero)</td>
<td>4 to 10.3 fl oz</td>
<td>12</td>
<td>1</td>
<td>Residue tolerances not established for all export destinations. Check with purchasers before incorporating this material in SWD management programs. No more than 46.35 fluid ounces of product can be applied per acre per year. Note that residue concerns for some IRAC Group 3A materials on fruit intended for export.</td>
</tr>
<tr>
<td>Blueberry maggot</td>
<td>Blueberry maggot fly activity typically begins in late May. Adults should be monitored with yellow sticky traps baited with ammonia food lures (ammonium acetate, ammonium carbonate, or ammonium bicarbonate). Check traps and change lures at least once per week. Treatments for blueberry maggot are not necessary unless adults have been observed in traps.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>malathion, (IRAC 1B) (Malathion) 6F</td>
<td>2.5 pt</td>
<td>12</td>
<td>1</td>
<td>There are several malathion formulations. No more than 2 applications of Malathion 6F can be made per year. No more than 5 pounds of malathion active ingredient from any source can be applied per acre per year. Use caution if this is the material of choice for multiple insect pests!</td>
</tr>
<tr>
<td></td>
<td>(Malathion) ULV</td>
<td>10 fl oz</td>
<td>12</td>
<td>1</td>
<td>No more than 5 applications of Malathion ULV can be made per year. No more than 5 pounds of malathion active ingredient from any source can be applied per acre per year. Use caution if this is the material of choice for multiple insect pests!</td>
</tr>
<tr>
<td></td>
<td>spinosad (IRAC 5) (Entrust)</td>
<td>1.25 to 2 fl oz</td>
<td>4</td>
<td>0</td>
<td>Entrust is OMRI listed. Cover sprays of Entrust are not as persistent as other materials. No more than 9 ounces of Entrust can be applied per acre per year.</td>
</tr>
<tr>
<td></td>
<td>spinetoram (IRAC 5) (Delegate)</td>
<td>3 to 6 oz</td>
<td>4</td>
<td>3</td>
<td>No more than 19.5 ounces of Delegate can be applied per acre per year.</td>
</tr>
<tr>
<td></td>
<td>phosmet (IRAC 1B) (Imidan)</td>
<td>1.33 lb</td>
<td>24</td>
<td>3</td>
<td>No more than 5 applications of Imidan can be made per year.</td>
</tr>
<tr>
<td></td>
<td>fenpropathrin (IRAC 3A) (Danitol 2.4 EC)</td>
<td>10.33 to 16 fl oz</td>
<td>24</td>
<td>3</td>
<td>No more than 2 applications of Danitol can be made per season.</td>
</tr>
<tr>
<td></td>
<td>Acetamiprid (IRAC 4A) (Assail)</td>
<td>2.5 to 5.3 oz</td>
<td>12</td>
<td>1</td>
<td>Assail is effective against blueberry maggot, but should not be used alone for SWD management.</td>
</tr>
<tr>
<td></td>
<td>imidacloprid (IRAC 4A) (Admire Pro and many other formulations)</td>
<td>2.1 to 2.8 fl oz</td>
<td>12</td>
<td>3</td>
<td>Many formulations of imidacloprid are available. Imidacloprid is not effective against SWD.</td>
</tr>
<tr>
<td></td>
<td>zeta cypermethrin (IRAC 3) (Mustang Max)</td>
<td>4 fl oz</td>
<td>12</td>
<td>1</td>
<td>Residue tolerances not established for all export destinations. Check with purchasers before incorporating this material in SWD management programs. No more than 6 applications of Mustang Max can be made per year. Note that there are residue concerns for some IRAC Group 3A materials on fruit intended for export.</td>
</tr>
<tr>
<td></td>
<td>zeta cypermethrin + bifenthrin (IRAC 3) (Hero)</td>
<td>4 to 10.3 fl oz</td>
<td>12</td>
<td>1</td>
<td>Residue tolerances not established for all export destinations. Check with purchasers before incorporating this material in SWD management programs. No more than 2 applications of Mustang Max can be made per year. Note that there are residue concerns for some IRAC Group 3A materials on fruit intended for export.</td>
</tr>
</tbody>
</table>

| Post Harvest | | | | | |
| Leaf Spots | Same as Petal Fall Treatments. | | | | |
| Blueberry bud mite | Only treat for blueberry bud mite if damage was a problem in the previous year. Many varieties are resistant to blueberry bud mite and do not typically require treatment. | | | | |
| | Post harvest hedging, cultural control | NA | NA | NA | Hedging removes infested issue/ |
| | oil superior-type IRAC unknown (many formulations) | 2 gal | 4 | 0 | Bud mite treatments should be applied after harvest and again four weeks later. |
| Sharpened leafhoppers | Sharpened leafhopper vectors blueberry stunt disease. To reduce disease transmitting populations of sharpened leafhopper, treatments should be timed to their flight activity. Sharpened leafhoppers can be monitored with yellow sticky traps. If present, blueberry stunt infected plants should be removed from fields. | | | | |
| | esfenvalerate (IRAC 3A) (Asana XL) 0.66 EC | 4.8 to 9.6 oz | 12 | 14 | Note that there are residue concerns for some IRAC Group 3A materials on fruit intended for export. |
| | imidacloprid (IRAC 4A) (Admire Pro and many other formulations) | 2.1 to 2.8 fl oz | 12 | 3 | Several formulations of imidacloprid are available. Carefully read the label to determine the correct rate for target pests. |
| | thiamethoxam (IRAC 4A) (Actara) | 3 to 4 oz | 12 | 3 | Allow 7 days between Actara treatments. Maximum 12 ounces per acre per season. |
| | acetamiprid (IRAC 4A) (Assail) | 2.5 to 5.3 oz | 12 | 1 | Allow 7 days between Assail treatments. |
| Japanese beetles | Japanese beetle feeding seldom requires treatment in North Carolina blueberries, and some pesticides applied for leafhoppers also control Japanese beetles. | | | | |
| | imidacloprid (IRAC 4A) (Admire Pro and many other formulations) | 2.1 to 2.8 fl oz | 12 | 3 | Several formulations of imidacloprid are available. Carefully read the label to determine the correct rate for target pests. |
| | esfenvalerate (IRAC 3A) (Asana XL) 0.66 EC | 4.8 to 9.6 oz | 12 | 14 | Note that there are residue concerns for some IRAC Group 3A materials on fruit intended for export. |
| | phosmet (IRAC 1B) (Imidan) | 1.33 lb | 24 | 3 | |
| Red humped and yellow necked caterpillars | Several species of caterpillars can feed on blueberries from late summer to early fall. These caterpillars can potentially defoliate bushes. But are often not widespread throughout the planting. | | | | |
| | Hand removal | NA | NA | NA | Hand removal is often sufficient to control populations because they are typically clustered on single or a few bushes. |
### Table 6-4: Blueberry Management Program

<table>
<thead>
<tr>
<th>Season Pest</th>
<th>Insecticide, Mode of Action Code, and Formulation</th>
<th>Amount of Formulation Per Acre</th>
<th>Restricted Entry Interval (REI) (hours)</th>
<th>Pre harvest Interval (PHI) (Days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Post Harvest (continued)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red humped and yellow necked caterpillars (continued)</td>
<td>Bacillus thuringiensis sub. kurstaki (Bt) (IRAC 11A) Dipel DF</td>
<td>0.5 to 1.0 lb</td>
<td>4</td>
<td>0</td>
<td>There are many Bt formulations. Dipel DF is OMRI listed.</td>
</tr>
<tr>
<td></td>
<td>tebufenozide (IRAC 1B) (Confirm) 2F</td>
<td>16 fl oz</td>
<td>4</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Red imported fire ants</td>
<td>pyrethrin (IRAC 7C) (Esteem Ant Bait 0.5% B)</td>
<td>1.5 to 2 lb</td>
<td>12</td>
<td>1</td>
<td>Do not water for 24 hours after application.</td>
</tr>
<tr>
<td></td>
<td>methoate (IRAC 7C) (Extinguish Ant Bait 0.5% B)</td>
<td>1 to 1.5 lb</td>
<td>4</td>
<td>0</td>
<td>Extinguish can be applied as a mound treatment or broadcast. Extinguish is labeled for use on cropland, but Extinguish Plus is NOT labeled for use on cropland. Read labels carefully.</td>
</tr>
<tr>
<td></td>
<td>Spinosad (IRAC 5) (Entrust)</td>
<td>3 to 5 tbsp/mound</td>
<td>4</td>
<td>1</td>
<td>Entrust is labeled for mound drench treatment. Entrust is OMRI listed.</td>
</tr>
<tr>
<td>Blueberry flea beetle</td>
<td>Spinosad (IRAC 5) (Entrust)</td>
<td>1.25 to 2 fl oz</td>
<td>4</td>
<td>0</td>
<td>Entrust is OMRI listed. Cover sprays of Entrust are not as persistent as other materials. No more than 3pz of Entrust can be applied per acre per year.</td>
</tr>
<tr>
<td></td>
<td>spinosad (IRAC 5) (Imidan)</td>
<td>1.33 lb</td>
<td>24</td>
<td>3</td>
<td>No more than 5 applications of Imidan can be made per year.</td>
</tr>
<tr>
<td></td>
<td>spinetoram (IRAC 5) (Delegate)</td>
<td>3 to 6 oz</td>
<td>4</td>
<td>3</td>
<td>No more than 19.5 ounces of Delegate can be applied per acre per year.</td>
</tr>
<tr>
<td></td>
<td>thiamethoxam (IRAC 4A) (Actara)</td>
<td>3 to 4 oz</td>
<td>12</td>
<td>3</td>
<td>Allow 7 days between Actara treatments. Maximum 12 oz per acre per season.</td>
</tr>
<tr>
<td></td>
<td>zeta cypermethrin (IRAC 3) (Mustang Max)</td>
<td>4 fl oz</td>
<td>12</td>
<td>1</td>
<td>No more than 6 applications of Mustang Max can be made per year. Note that there are residue concerns for some IRAC Group 3A materials on fruit intended for export.</td>
</tr>
<tr>
<td></td>
<td>zeta cypermethrin + bifenthrin (IRAC 3) (Hero)</td>
<td>4 to 10.3 fl oz</td>
<td>12</td>
<td>1</td>
<td>No more than 46.35 fluid ounces of product can be applied per acre per year. Note that there are residue concerns for some IRAC Group 3A materials on fruit intended for export.</td>
</tr>
</tbody>
</table>

**Further Information**
NC Small Fruit and Specialty Crop IPM, www.ncsmallfruitsipm.blogspot.com

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Caneberry Management Program

H. J. Burrack, Entomology Extension and Research, and W. O. Cline, Plant Pathology

The Insecticide Resistance Action Committee (IRAC) and Fungicide Resistance Action Committee (FRAC) group insecticides into mode of action categories. These categories are listed following the pesticide and formulation names. To reduce the risk of resistance development, avoid successive applications of insecticides with the same IRAC or FRAC designation for the same pest. Organically acceptable insecticides (OMRI listed) are indicated in Comments and Precautions.

Insecticides should only be applied if the pest of concern is present in economically damaging levels. If insect injury does not result in greater loss than the cost of treatment, treatment is not justified. Therefore, a degree of insect presence should be tolerated and insecticides should not necessarily be applied on a scheduled basis as may be appropriate for fungicides.

Pesticides should not be applied when bees are actively foraging. If necessary, apply insecticides and fungicides in the evening when bees are not active. Pay attention to pesticide label information regarding pollinator protection.

Many insecticide active ingredients are available in generic formulations. For brevity, these formulations are not generally listed. Trade names are listed to aid in identifying products and not intended to promote this use of these products or to discourage 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.

### Table 6-5. Caneberry Management Program

<table>
<thead>
<tr>
<th>SEASON</th>
<th>Pest</th>
<th>Rate of Formulation per Acre</th>
<th>Restricted Entry Interval (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Comments and Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late Winter or Early Spring</td>
<td>Anthracnose, Spur blight, Cane blight</td>
<td>liquid lime-sulfur, FRAC M2</td>
<td>6 to 12 gal</td>
<td>See label</td>
<td>See label</td>
</tr>
<tr>
<td></td>
<td>Copper-based products</td>
<td>FRAC M1</td>
<td>See label</td>
<td>See label</td>
<td>See label</td>
</tr>
<tr>
<td></td>
<td>Raspberry crown borer</td>
<td>Removing infested plants is an important cultural control. In blocks with a history of raspberry crown borer, apply an insecticide either in late October to early November or early April (one application only) to provide a barrier for larvae boring into canes as they emerge from overwintering hibernacula. Follow label instructions for water volume and application methods.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>bifenthrin, IRAC 3A (Brigade WSB)</td>
<td>16 oz</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>esfenvalerate, IRAC 3A (Asana XL)</td>
<td>3.2 to 6.4 fl oz</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>chlorantraniliprole, IRAC 28 (Altacor)</td>
<td>3-4.5 oz</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Just Before Blooms Open</td>
<td>Anthracnose, Cane blight, Cane cariner, Leaf spots, Spur blight</td>
<td>boscalid + pyraclostrobin (Pristine) 38 WDG, FRAC 7 + 11</td>
<td>18.5 to 23 oz</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>captan, FRAC M4 (Captain 50W) (Captain 80WDG) (Captect 4L)</td>
<td>4 lb</td>
<td>2.5 lb</td>
<td>2 qt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pyraclostrobin (Cabrio 20EG), FRAC 11</td>
<td>14 oz</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>azoxystrobin, FRAC 11 (Abound 2SC)</td>
<td>6.2 to 15.4 fl oz</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>azoxystrobin + propiconazole (Quilt Xcel), FRAC 11 + 3</td>
<td>14 to 21 fl oz</td>
<td>12</td>
<td>30</td>
</tr>
</tbody>
</table>

### Strawberry clipper weevil

Strawberry clipper weevil females lay their eggs in flower buds and clip the pedicle, causing the bud to wilt and drop off the plant. Some blackberry and raspberry varieties can compensate for bud injury, and strawberry clipper may not require treatment. Do not apply insecticides when bees are foraging.

| | Rate of Formulation per Acre | Restricted Entry Interval (hours) | Preharvest Interval (PHI) (days) | Comments and Precautions |
| | 3.2 to 6.4 fl oz | 12 | 3 | Do not exceed 12.8 fluid ounces Brigade per acre per season. |
| | 1 to 2 qt | 12 | 7 | |
| | 10.66 to 16 fl oz | 24 | 3 | Do not exceed 32 fluid ounces per acre per season. |

### Gall midge

Gall midge larvae can feed on developing buds, and damage can appear similar to cold injury. Fields with a history of gall midge damage may require treatment.

| | Rate of Formulation per Acre | Restricted Entry Interval (hours) | Preharvest Interval (PHI) (days) | Comments and Precautions |
| | 3.2 to 6.4 fl oz | 12 | 3 | Do not exceed 12.8 fluid ounces Brigade per acre per season. |
| | 10.66 to 16 fl oz | 24 | 3 | Do not exceed 32 fluid ounces per acre per season. |
### Table 6-5. Caneberry Management Program

<table>
<thead>
<tr>
<th>SEASON and Petal Fall</th>
<th>Pesticide, Formulation, and IRAC</th>
<th>Rate of Formulation per Acre</th>
<th>Restricted Entry Interval (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Comments and Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bloom and Petal Fall</strong></td>
<td><strong>Pesticides may be hazardous to pollinators. When making any pesticide application during bloom, apply material in the evening when bees are not foraging to allow for as long a dry time as possible. See Table 5.1. Relative Toxicity of Pesticides to Bees for more information.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Double blossom</strong></td>
<td>Sprays during bloom are most important for control of double blossom. Begin sprays when first infected blossoms open and continue every 10 to 14 days through bloom. Rotate strobilurin (Group 11) fungicides with Switch to avoid resistance. It is important to protect primocanes as long as infected flowers continue to open.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>azoxystrobin , FRAC 4 (Abound 2SC)</td>
<td>6.2 to 15.4 fl oz</td>
<td>4</td>
<td>0</td>
<td><strong>Do not tank mix Pristine with any other pesticide products, adjuvants, liquid fertilizers, nutrients, or other additives.</strong> Pristine will also control botrytis.</td>
<td></td>
</tr>
<tr>
<td>boscalid + pyraclostrobin (Pristine 38WDG), FRAC 7 + 11</td>
<td>18.5 to 23 oz</td>
<td>12</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cyprodinil + fludioxonil (Switch 62.5 WG), FRAC 9 + 12</td>
<td>11 to 14 oz</td>
<td>12</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>azoxystrobin + propiconazole (Quint Xcel), FRAC 11 + 3</td>
<td>14 to 21 fl oz</td>
<td>12</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bordeaux mixture FRAC M1</td>
<td>See note at end of table</td>
<td>24</td>
<td>1</td>
<td>Crop injury may occur with Bordeaux mixture under slow drying conditions or in hot weather. Some injury often accompanies the use of copper fungicides; if injury is excessive, discontinue use.</td>
<td></td>
</tr>
<tr>
<td><strong>Botrytis fruit rot</strong></td>
<td>Apply at early bloom and repeat at full bloom. Rotate iprodione, Switch, and Elevate or CaptEvate to reduce the likelihood of resistance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>captan, FRAC M4 (Captain 50W) (Captain 80 WDG) (Captec 4L)</td>
<td>4 lb</td>
<td>72</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fenhexamid (Elevate) 50 WDG, FRAC 17</td>
<td>1.5 lb</td>
<td>12</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iprodione (several brands) 50 WG, FRAC 2 4F</td>
<td>1 to 2 lb</td>
<td>24</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cyprodinil + fludioxonil (Switch 62.5 WG), FRAC 9 + 12</td>
<td>11 to 14 oz</td>
<td>12</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>captan + fenhexamid (CaptEvate) 68WDG, FRAC M4 + 17</td>
<td>3.5 lb</td>
<td>48</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cane canker, Cane blight, Spur blight</strong></td>
<td>Do not make more than 6 applications per season. Do not exceed 12.8 fluid ounces Danitol per acre per season.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>captan, FRAC M4 (Captain 50W) (Captain 80 WDG) (Captec 4L)</td>
<td>4 lb</td>
<td>72</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pyraclostrobin (Cabi20E), FRAC 11</td>
<td>14 oz</td>
<td>12</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>boscalid + pyraclostrobin (Pristine 38WDG), FRAC 7 + 11 (Abound 2SC)</td>
<td>6.2 to 15.4 fl oz</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>azoxystrobin, FRAC 11 (Abound 2SC) (Dipel DF)</td>
<td>0.5 to 1 lb</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>azoxystrobin + propiconazole (Quint Xcel), FRAC 11 + 3</td>
<td>4 fl oz</td>
<td>12</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rednecked cane borer</strong></td>
<td>Scout canes during winter pruning. If 10% or greater of the primocanes per row, or more of the primocanes than will be removed through pruning have rednecked cane borer galls, control is justified. Treat after first bloom or when adults are observed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bifenthrin, IRAC 3A (Brigade 2EC)</td>
<td>3.2 to 6.4 fl oz</td>
<td>12</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strawberry clipper weevil</strong></td>
<td>See JUST BEFORE BLOOMS OPEN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Post-Bloom

<table>
<thead>
<tr>
<th>Pest</th>
<th>Applications for these diseases should be made every 14 days after petal fall until harvest</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anthracnose, Leaf spots, Rusts, Powdery mildew</strong></td>
<td>See JUST BEFORE BLOOMS OPEN</td>
<td></td>
</tr>
<tr>
<td><strong>Japanese beetles</strong></td>
<td>Japanese berries can tolerate some foliar feeding by Japanese beetles, but little work has been done to determine when foliar feeding impacts yield. Do not use Japanese beetle pheromone traps.</td>
<td></td>
</tr>
<tr>
<td>carbaryl, IRAC 1A (Sevin) 50 WP (Sevin) 4XLR</td>
<td>2 lb</td>
<td>12</td>
</tr>
<tr>
<td>fenpropathrin, IRAC 3A (Danitol) 2.4 EC</td>
<td>10.66 to 16 fl oz</td>
<td>24</td>
</tr>
<tr>
<td>azeta-cypermethrin (Mustang Max) IRAC 3</td>
<td>4 fl oz</td>
<td>12</td>
</tr>
</tbody>
</table>

### Leaf rollers

Leafrolling caterpillars can feed on caneberry foliage. Folage damage is typically not economically significant, but caterpillars can occasionally form webs on fruit. If caterpillars are impacting fruit, treatment may be justified.

<table>
<thead>
<tr>
<th>Pest</th>
<th>Applications for these diseases should be made every 14 days after petal fall until harvest</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacillus thuringiensis (Bt), IRAC 11A (Dipel DF)</td>
<td>0.5 to 1 lb</td>
<td>4</td>
</tr>
<tr>
<td>chlorantraniliprole, IRAC 28 (Altacor)</td>
<td>3-4.5 oz</td>
<td>4</td>
</tr>
</tbody>
</table>
### Table 6-5. Canberry Management Program

<table>
<thead>
<tr>
<th>SEASON Pest</th>
<th>Pesticide, Formulation, and IRAC</th>
<th>Rate of Formulation per Acre</th>
<th>Restricted Entry Interval (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Comments and Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Post-Bloom (continued)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spotted wing drosophila (SWD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>spinetoram, IRAC 5 (Delegate)</td>
<td>3 to 6 oz</td>
<td>4</td>
<td>1</td>
<td>Do not exceed 19.5 ounces Delegate per acre per season.</td>
</tr>
<tr>
<td></td>
<td>spinosad, IRAC 5 (Entrust)</td>
<td>1.25 to 2.5 oz</td>
<td>4</td>
<td>1</td>
<td>Do not exceed 9 ounces Entrust per acre per season. Entrust is OMRI listed.</td>
</tr>
<tr>
<td></td>
<td><strong>Stink bugs, Plant bugs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stink bug feeding does not typically damage berries, but they may be contamination pests during harvest. Plant bug and stink bugs may also feed on developing buds or shoots.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>esfenvalerate, IRAC 3A (Asana XL)</td>
<td>9.6 fl oz</td>
<td>12</td>
<td>7</td>
<td>Avoid applications when bees are foraging. Apply during evenings or early morning.</td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 3A (Danitol 2.4EC)</td>
<td>10.66 to 16 fl oz</td>
<td>24</td>
<td>3</td>
<td>Do not exceed 32 fluid ounces per acre per season.</td>
</tr>
<tr>
<td></td>
<td>thiramethoxam, IRAC 4A (Actana 25HDS)</td>
<td>3 oz</td>
<td>12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Spider mites</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>There is no research-based treatment threshold for spider mites in canberries, but treatment is recommended when a random sample of leaflets from the planting has an average of 10 mite mites. Leaflets should be examined with a minimum 10x hand lens to determine mite counts. Spider mites are more significant pests of raspberries than blackberries. Insecticides used against other pests may flare spider mite populations, particularly IRAC 1 and 3 materials. Observe plants for spider mites following treatment with these materials.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenthrin, IRAC Unknown (Acramite 50WS)</td>
<td>1 lb</td>
<td>12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>hexythiazox, IRAC 10A (Savey 50DG)</td>
<td>6 oz</td>
<td>12</td>
<td>3</td>
<td>Savex is primarily active against eggs and immature mites. Apply when populations are low.</td>
</tr>
<tr>
<td></td>
<td>horticultural oils, IRAC Unknown (SaT-Side)</td>
<td>1 to 2% by volume</td>
<td>4</td>
<td>0</td>
<td>Summer oils are effective in moderating low mite populations pre-harvest. Use on a trial basis only until certain oil will not result in fruit finish problems. Do not use oils within 14 days of using any sulfur-containing material. Do not apply oils when temperatures will exceed 90 degrees F or dip below 50 degrees F.</td>
</tr>
<tr>
<td></td>
<td>horticultural oils, IRAC Unknown (JMS Stylet Oil)</td>
<td>0.75 to 1.5% by volume</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>horticultural oils, IRAC Unknown (Organic JMS Stylet Oil)</td>
<td>0.75 to 1.5% by volume</td>
<td>4</td>
<td>0</td>
<td>Organic JMS Stylet Oil is OMRI listed.</td>
</tr>
<tr>
<td><strong>Harvest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Botrytis fruit rot</strong></td>
<td>boscalid + paraoxon (Pristine 38 WDG), FRAC 7 + 11</td>
<td>18.5 to 23 oz</td>
<td>12</td>
<td>0</td>
<td>Do not tank mix Pristine with any other pesticide products, adjuvants, liquid fertilizers, nutrients, or other additives.</td>
</tr>
<tr>
<td></td>
<td>cyprodinil + fludioxonil (Switch 62.5 WG), FRAC 9 + 12</td>
<td>11 to 14 oz</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fenhexamide (Eleveate 50 WDG), FRAC 17</td>
<td>1.5 lb</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iprodione (several brands) 50 WG, FRAC 2 4F</td>
<td>1 to 2 lb 1 to 2 pt</td>
<td>24</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>captan, FRAC M4 (Captan 50W) (Captan 80 WDG) (Captex 4L)</td>
<td>4 lb 2.5 lb 2 fl oz 2 fl oz</td>
<td>72</td>
<td>3</td>
<td>Include captan in this spray if ripe rot is a problem. Pristine will also control ripe rot. Captan and CaptiEvate have a 3-day PHI.</td>
</tr>
<tr>
<td></td>
<td>captan + fenhexamide (CaptiEvate) 88W DG, FRAC M4 + 17</td>
<td>3.5 lb 48</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flower thrips</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flower thrips can be a contamination pest at harvest. Fruit can be placed in a clear plastic bag before harvest and observed for flower thrips. There is no evidence at this time to suggest that flower thrips damage fruit or flowers and reduce yield.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>acetamiprid IRAC 4A (Assail 30SG)</td>
<td>4.5 to 5.3 oz</td>
<td>12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spinetoram, IRAC 5 (Delegate)</td>
<td>3 to 6 oz</td>
<td>4</td>
<td>1</td>
<td>Do not exceed 19.5 ounces Delegate per acre per season.</td>
</tr>
<tr>
<td></td>
<td>spinosad, IRAC 5 (Entrust)</td>
<td>1.25 to 2.5 oz</td>
<td>4</td>
<td>1</td>
<td>Do not exceed 9 ounces Entrust per acre per season. Entrust is OMRI listed.</td>
</tr>
<tr>
<td></td>
<td>zeta cypheirimin IRAC 3 (Mustang Max)</td>
<td>4.0 fl oz</td>
<td>12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Spotted wing drosophila</strong></td>
<td>Spotted wing drosophila (SWD) is a pest of soft skinned fruit. Female SWD lay eggs in ripe and ripening fruit, which can appear otherwise undamaged externally. Because SWD is relatively new to the eastern US, it is not listed on many pesticide labels. Growers are encouraged to both monitor adult flies in their fields and larval presence in berries. Weekly or twice weekly insecticide applications are currently recommended beginning at fruit ripening and continuing through the end of harvest. More information about SWD biology, monitoring, and management is available at <a href="http://swd.ces.ncsu.edu">http://swd.ces.ncsu.edu</a>.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenthrin, IRAC 3A (Brigade 2EC)</td>
<td>3.2 to 6.4 fl oz</td>
<td>12</td>
<td>3</td>
<td>Do not exceed 12.8 fluid ounces Brigade per acre per season.</td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 3A (Danitol 2.4EC)</td>
<td>10.66 to 16 fl oz</td>
<td>24</td>
<td>3</td>
<td>Do not exceed 32 fluid ounces per acre per season.</td>
</tr>
<tr>
<td></td>
<td>malathion, IRAC 1B (Malathion 8F)</td>
<td>2 pt</td>
<td>24</td>
<td>1</td>
<td>Make no more than 4 applications per year.</td>
</tr>
<tr>
<td></td>
<td>spinetoram, IRAC 5 (Delegate)</td>
<td>3 to 6 oz</td>
<td>4</td>
<td>1</td>
<td>Do not exceed 19.5 ounces Delegate per acre per season.</td>
</tr>
<tr>
<td></td>
<td>spinosad, IRAC 5 (Entrust)</td>
<td>1.25 to 2.5 oz</td>
<td>4</td>
<td>1</td>
<td>Do not exceed 9 ounces Entrust per acre per season. Entrust is OMRI listed.</td>
</tr>
<tr>
<td></td>
<td>zeta cypheirimin IRAC 3 (Mustang)</td>
<td>4.3 fl oz</td>
<td>12</td>
<td>1</td>
<td>Do not exceed 25.8 fluid ounces Mustang per acre per season.</td>
</tr>
</tbody>
</table>
### Table 6-5. Caneberry Management Program

<table>
<thead>
<tr>
<th>SEASON Pest</th>
<th>Pesticide, Formulation, and IRAC</th>
<th>Rate of Formulation per Acre</th>
<th>Restricted Entry Interval (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Comments and Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Harvest (continued)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japanese beetles and green June beetles</td>
<td>carbaryl, IRAC 1A (Sevin) 50 WP (Sevin 4 XLR)</td>
<td>2 lb 2 qt</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fenpropimorph, IRAC 3A (Dacosta) 2.4 EC</td>
<td>10.6 to 16 fl oz</td>
<td>24</td>
<td>3</td>
<td>Do not exceed 32 fluid ounces Danitol per acre per season.</td>
</tr>
<tr>
<td></td>
<td>zeta-cypermethrin (Mustang Max) IRAC 3</td>
<td>4 fl oz</td>
<td>12</td>
<td>1</td>
<td>Do not make more than 6 applications per season.</td>
</tr>
<tr>
<td><strong>Just After Harvest and 14 Days Later</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaf spots</td>
<td>captan (Captain 50W) (Captain 90 WDG)</td>
<td>4 lb 2.5 lb</td>
<td>72</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Japanese beetle</td>
<td>See Post Bloom</td>
<td></td>
<td></td>
<td></td>
<td>Japanese beetle treatments are necessary post harvest only if feeding is removing greater than 10% of foliage on primocanes.</td>
</tr>
<tr>
<td><strong>Late October or Early November</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raspberry crown borer</td>
<td>Raspberry crown borer treatments should be applied once per year, either in late fall or early spring.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenthrin, IRAC 3A (Brigade WSBR) IRAC 3A</td>
<td>16 oz</td>
<td>12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>chlorantraniliprole, IRAC 28 (Altacon)</td>
<td>3.4 to 5 oz</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Dormant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scale insects</td>
<td>Scale insects may be present on caneberrys but are typically kept below economically damaging levels by parasitoids and predators. Pruning to maintain an open canopy minimizes scale populations. Examine plants after harvest and during pruning for scale, and if present in high numbers or resulting in sooty mold growth, consider a dormant season oil treatment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>horticultural oils IRAC Unknown (Saf T Side)</td>
<td>1 to 2% by volume</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>horticultural oils IRAC Unknown (JMS Stylet Oil)</td>
<td>0.75 to 1.5% by volume</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>horticultural oils IRAC Unknown (Organic JMS Stylet Oil)</td>
<td>0.75 to 1.5% by volume</td>
<td>4</td>
<td>0</td>
<td>Organic JMS Stylet Oil is OMRI listed.</td>
</tr>
<tr>
<td>Raspberry cane borer, Red neck cane borer</td>
<td>During winter pruning, examine canes for raspberry cane borer injury. Prune canes girdled by raspberry cane borer 2 to 3 cm below the lower girdle or gall. If evidence of boring is present below this cut, successive cuts should be made until no further injury is observed. Destroy or remove cuttings to prevent reinfection.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Special Rust Sprays</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cane and leaf rust, Orange rust</td>
<td>Begin applications in the spring just before orange rust pustules are formed on the lower leaf of brambles (use wild blackberries as indicators). Continue at 10- to 14-day intervals until the mean temperature remains above 77 degrees F. Infections can also occur in the late summer and fall.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bosalid + pyraclostrobin (Pristine 38 WG), FRAC 7 + 11</td>
<td>18.5 to 23 oz</td>
<td>12</td>
<td>0</td>
<td>Do not tank mix Pristine with any other pesticide products, adjuvants, liquid fertilizers, nutrients, or other additives. Where orange rust has been a problem, alternate Rally and Cabrio or Pristine or azoxystrobin at 14-day intervals. For late leaf rust, begin when symptoms first appear, and continue on a 14-day interval.</td>
</tr>
<tr>
<td></td>
<td>myclobutanil (several brands) 40 WSP, DF, WDG, FRAC 3</td>
<td>1.25 to 2.5 oz</td>
<td>24</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pyraclostrobin (Cabrio 20EG), FRAC 11</td>
<td>14 oz</td>
<td>12</td>
<td>0</td>
<td>Where orange rust has been a problem, alternate Rally and Cabrio or Pristine or azoxystrobin at 14-day intervals.</td>
</tr>
<tr>
<td></td>
<td>azoxystrobin, FRAC 11 (Abound 2SC)</td>
<td>6.2 to 15.4 fl oz</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>azoxystrobin + propiconazole (Quint Xcel), FRAC 11 + 3</td>
<td>14 to 21 fl oz</td>
<td>12</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td><strong>Special Treatments for Phytophthora Root Rot</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phytophthora root rot</td>
<td>mefenoxam (Ridomil Gold SL), FRAC 4</td>
<td>——</td>
<td>48</td>
<td>45</td>
<td>Apply 0.25 pint per 1,000 linear feet of row in a 3 feet wide band in the spring and fall after harvest. Ridomil Gold is registered for raspberries only. 45-day phis.</td>
</tr>
<tr>
<td></td>
<td>fosetyl Al (Aliette WSP), FRAC 33</td>
<td>5 lb</td>
<td>12</td>
<td>60</td>
<td>Begin when growth is 1 to 3 inches long and continue at 45- to 60-day intervals through the growing season. Registered for blackberries and raspberries. Maximum of four applications per year. 60-day phis.</td>
</tr>
<tr>
<td></td>
<td>phosphite fungicides, FRAC 33</td>
<td>See label</td>
<td>See label</td>
<td>See label</td>
<td>Several phosphorus acid products are registered for control of Phytophthora root rot, including Prophyt and Agri-Fos. See label for recommendations.</td>
</tr>
<tr>
<td><strong>Preplant Treatments for Nematodes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nematodes</td>
<td>1,3 dichloropropene 37% + chloropicrin 57% (Pic-Clor 60 EC)</td>
<td>19.5 to 44.5 gal</td>
<td>5</td>
<td>NA</td>
<td>Preplant interval should be 4 to 8 weeks, or longer if dissipation is slow. See label for additional information.</td>
</tr>
<tr>
<td></td>
<td>metam sodium (Vapam, Sectagon II, Busan 1020)</td>
<td>75 gal</td>
<td>See label</td>
<td>NA</td>
<td>Preplant interval is a minimum of 4 weeks.</td>
</tr>
</tbody>
</table>

Bunch Grape Management Program

M. Nita, Virginia Tech, Plant Pathology Research and Extension; H. J. Burrack, Entomology Extension and Research

Insect management differs from disease management in that insects (with a few exceptions in wine grapes, which are noted) should only be treated when damaging populations are present. Where treatment thresholds are known, these are provided. For many insect pests of wine grapes in the southeast, thresholds do not exist. Consult cooperative extension personnel for management recommendations if insects for which there are no thresholds are present.

The Insecticide Resistance Action Committee (IRAC) and the Fungicide Resistance Action Committee (FRAC) group insecticides and fungicides into mode of action categories. These categories are listed following the pesticide and formulation names. To reduce the risk of resistance development, avoid successive applications of insecticides or fungicides with the same IRAC or FRAC code for the same pest. Organically acceptable insecticides (OMRI listed) are indicated in Precautions and Remarks.

Some insecticide active ingredients are available in several formulations and under several trade names. For simplicity, the most common trade names and associated rates are listed. This is not intended to encourage the use of these products over generic versions.

Table 6-6. Bunch Grape Management Program

<table>
<thead>
<tr>
<th>When to Spray and Disease/Pest</th>
<th>Pesticide, Formulation, and IRAC Code</th>
<th>Amount of Formulation to Use per Acre</th>
<th>Reentry Interval (REI) (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dormant</td>
<td>Anthracnose, Black rot, Phomopsis</td>
<td>Cuprofix Ultra Dispers FRAC M1</td>
<td>4 lb</td>
<td>48</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liquid lime sulfur, FRAC M2</td>
<td>10 gal</td>
<td>48</td>
<td>0</td>
</tr>
<tr>
<td>Bud Swell</td>
<td>Grape flea beetle</td>
<td>Carbaryl, IRAC 1A (Sevin XLR Plus)</td>
<td>1 to 2 qt</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chlorantraniliprole IRAC 28 (Altacon)</td>
<td>2 to 4.5 oz</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fenpropathrin, IRAC 3 (Danitol 2.4 EC)</td>
<td>10.66 to 21.33 fl oz</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Methoxyfenozide, IRAC 18 (Intrepid 2F)</td>
<td>12 to 16 fl oz</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spinetoram IRAC 5 (Delegate 25 WG)</td>
<td>3 to 5 oz</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spinosad, IRAC 5 (Entrust 80WP)</td>
<td>2.5 oz</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flubendiamide, IRAC 28 (Belt SC)</td>
<td>3 to 4 fl oz</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Climbing cutworms</td>
<td>Scouting for adult beetles and damaged buds.</td>
<td>Bacillus thuringiensis (Bt), IRAC 11</td>
<td>rates vary</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carbaryl, IRAC 1A (Sevin XLR Plus)</td>
<td>1 to 2 qt</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chlorantraniliprole IRAC 28 (Altacon)</td>
<td>2 to 4.5 oz</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fenpropathrin, IRAC 3 (Danitol 2.4 EC)</td>
<td>10.66 to 21.33 fl oz</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Methoxyfenozide, IRAC 18 (Intrepid 2F)</td>
<td>12 to 16 fl oz</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spinetoram IRAC 5 (Delegate 25 WG)</td>
<td>3 to 5 oz</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spinosad, IRAC 5 (Entrust 80WP)</td>
<td>2.5 oz</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flubendiamide, IRAC 28 (Belt SC)</td>
<td>3 to 4 fl oz</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Mealybugs, European red mite, and scale insects</td>
<td>Scouting for mealybugs and European red mite.</td>
<td>Horticultural oils (Omni Supreme Spray Oil) (JMS Stylet Oil)</td>
<td>0.5 to 1% by volume 1 to 2% by volume 1 to 2% by volume</td>
<td>If mealybugs or ERM were of economic concern during the previous season and present during dormant season, dormant oil treatment may be justified. Do not apply oil treatments in combination with sulfur or within 30 days of sulfur application. Do not apply oils when temperature will exceed 90 degrees F or dip below freezing. Organic JMS Stylet Oil is OMRI listed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>JMS Stylet Oil (Organic JMS Stylet Oil)</td>
<td>0.5 to 1% by volume 1 to 2% by volume 1 to 2% by volume</td>
<td>If mealybugs or ERM were of economic concern during the previous season and present during dormant season, dormant oil treatment may be justified. Do not apply oil treatments in combination with sulfur or within 30 days of sulfur application. Do not apply oils when temperature will exceed 90 degrees F or dip below freezing. Organic JMS Stylet Oil is OMRI listed.</td>
<td></td>
</tr>
<tr>
<td>At or Just Before Budburst</td>
<td>Leafhopper/suppression (Pierce’s Disease suppression)</td>
<td>Clothianidin, IRAC 4A (Clutch)</td>
<td>6 oz</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cyfluthrin, IRAC 3 (Baythroid 2EC)</td>
<td>2.4 to 3.2 fl oz</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dinotefuran, IRAC 4A (Venom)</td>
<td>5 to 6 oz (soil) 1 to 3 oz (foliar)</td>
<td>12</td>
<td>28</td>
</tr>
</tbody>
</table>
Table 6-6. Bunch Grape Management Program

<table>
<thead>
<tr>
<th>When to Spray and Disease/Pest</th>
<th>Pesticide, Formulation, and IRAC, FRAC Code</th>
<th>Amount of Formulation to Use per Acre</th>
<th>Reentry Interval (REI) (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
</table>
| At or Just Before Budburst (continued) | imidacloprid, IRAC 4A (Admire Pro) | 7 to 14 fl oz | 12 | 30 | Soil application  
Foliar application  
Several concentrations of imidacloprid (1.6F, 2F, 4F, and 4.6F) are available. Carefully read label to determine correct rate for target pests. |
|                                  | horticultural oils (see Bud Swell) | 9 to 12 oz | 12 | 30 | |
|                                  | buprofezin, IRAC 16 (Applaud 70DF) | 1.6 to 3.2 qt | 24 | 66 | |
|                                  | acetamiprid, IRAC 4A (Assail 30SG) | 2.5 oz | 12 | 7 | |

Mealybugs

Only consider a systemic soil applied insecticide (i.e., Venom, Admire Pro, or Clutch) for mealybugs if these insects have been a problem in the previous year or if dormant sampling suggests that high populations are present. Only apply foliar treatments if mealybug presence is confirmed in the planting.

clothianidin, IRAC 4A (Clutch) | 6 oz | 12 | 30 | Soil application |

cyfluthrin, IRAC 3 (Baythroid 2EC) | 2.4 to 3.2 fl oz | 12 | 3 | Soil application |
dinotefuran, IRAC 4A (Venom) | 5 to 6 oz | 12 | 28 | Soil application  
Foliar treatment |

imidacloprid, IRAC 4A (Admire Pro) | 1.3 fl oz | 12 | 14 | Foliar treatment  
Soil application  
Several concentrations of imidacloprid (1.6F, 2F, 4F, and 4.6F) are available. Carefully read label to determine correct rate for target pests. |

New Shoots (7- to 10-day interval beginning at 1-inch shoot growth until Prebloom Spray)

Phomopsis, Black rot,  
Powdery mildew,  
Downy mildew

The main target in the new shoot protection is Phomopsis. A powdery mildew fungicide is generally not needed in the first spray (1-inch shoot growth) unless the disease has been a problem in previous years. In subsequent sprays, include a fungicide for powdery mildew control. Sulfur is a very economical option, and generally recommended for early season applications.

The other options are quinoxyfen, metrafenone or a sterol inhibiting fungicide (DMI or SI) fungicide (myclobutanil, tebuconazole, triflumizole, tetraconazole), or a SDHI fungicide (boscalid, fluopyram, etc.). In the example shown here, DMI fungicides are listed.

However, in order to avoid resistance of the powdery mildew fungus to these fungicides, it is very important to 1) limit the use of one FRAC code to 2-3 applications per season (with exceptions of the codes start with M1, 2) use the maximum-labeled rate, and 3) combine with sulfur (i.e., rotation of FRAC code is the key). Thus, in order to have better options for the critical period for powdery mildew (prebloom to 4-5 weeks after bloom), it is often recommended to use sulfur until prebloom and then add another powdery mildew material.

Notes: a) a DMI, fenamidone (e.g., Rubigan, Vintage) is no longer in market, but as long as you have the label, you can still use the product.

mancozeb, FRAC M3  
75 DF | 4 F | PLUS — sulfur (various brands), FRAC M2 | 2 to 4 lb | 1.6 to 3.2 qt | see label | 24 | 66 | Often, mancozeb + sulfur application is sufficient until pre-bloom.  
However, you may add one or more newer class of fungicide(s), especially if you have a chronic issue with a specific disease(s). If you decided to do so, please refer to prebloom recommendations for mixing partners.  
There are various formulations of mancozeb and sulfur products. Please follow the label for the application rate. Gavel is one of the mancozeb products, but it contains zoxamide, which has efficacy against downy mildew (i.e., if you have downy mildew issues, Gavel should provide better efficacy than mancozeb alone).  
Avoid sulfur on sulfur sensitive varieties. Some sulfur injury may occur on sulfur-tolerant varieties if the temperature exceeds 85 degrees F.  
The activity of sulfur is reduced at temperatures less than 65 degrees F.  
The activity of sulfur is reduced at temperatures less than 65 degrees F.  
The activity of sulfur is reduced at temperatures less than 65 degrees F. Do not mix sulfur (or captan) and oil since it may result in grape injury. |

cove 75 DF, FRAC 22 + M3 | PLUS — sulfur (various brands), FRAC M2 | 2.5 lb | see label | 24 | 66 | |

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### Table 6-6. Bunch Grape Management Program

<table>
<thead>
<tr>
<th>When to Spray and Disease/Pest</th>
<th>Pesticide, Formulation, and IRAC, FRAC Code</th>
<th>Amount of Formulation to Use per Acre</th>
<th>Reentry Interval (REI) (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prebloom</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phomopsis, Black rot, Powdery mildew, Downy mildew</td>
<td>mancozeb, FRAC M3 75 DF 4 F</td>
<td>2 to 4 lb 1.6 to 3.2 qt</td>
<td>24</td>
<td>66</td>
<td>Where black rot is a problem, combine mancozeb with a sterol inhibiting fungicide (FRAC 3, aka DMI, SI fungicides). Captan is weak on black rot. Myclobutanil and tebuconazole are more active on black rot than triflumizole. See comments under New Shoots regarding resistance to SI fungicides. There is a risk of burning on leaves due to sulfur when temperature exceeds 85 degrees F and leaves are wet from sulfur application. Make sure to have a time to dry when a high temperature is expected, or avoid application of sulfur when air temperature if above 85 degrees F.</td>
</tr>
<tr>
<td></td>
<td>myclobutanil (various brands), FRAC M2 PLUS sulfur (various brands), FRAC M2</td>
<td>see label</td>
<td>24</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>quinoxyfen (Quintec 25C), FRAC 43</td>
<td>3 to 4 fl oz 12 fl oz 32 oz 64 oz</td>
<td>12</td>
<td>14</td>
<td>Note: quinoxyfen will work only against powdery mildew.</td>
</tr>
<tr>
<td></td>
<td>metrafenone (Vivindo) 2.5SC, FRAC 48</td>
<td>10.3 to 15.4 fl oz</td>
<td>12</td>
<td>14</td>
<td>Note: metrafenone will work only against powdery mildew.</td>
</tr>
<tr>
<td></td>
<td>myclobutanil (various brands), FRAC 3 40 WSP, DF, WDG</td>
<td>4 oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tebuconazole (various brands), FRAC 3 5 DF, 45 WDG</td>
<td>4 oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>triflumizole (Procure 50 WS), FRAC 3</td>
<td>4 to 8 oz</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tetraconazole (Mettle 125ME), FRAC 3</td>
<td>3 to 5 fl oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>azoxystrobin (Abound 2 SC), FRAC 11</td>
<td>11 to 15.4 fl oz</td>
<td>4</td>
<td>14</td>
<td>Do not make more than two sequential applications of Flint, Sovran, Abound, Pristine, Adament, Luna Experience, or Quadris Top before rotating to a non-QoI fungicide.</td>
</tr>
<tr>
<td></td>
<td>kresoxim-methyl (Sovran 50 WG), FRAC 11</td>
<td>3.2 to 4 oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trifloxystrobin (Flint 50 WG), FRAC 11</td>
<td>1.5 to 2 oz</td>
<td>12</td>
<td>14</td>
<td>Do not apply Flint to Concord grapes.</td>
</tr>
<tr>
<td></td>
<td>boscalid + pyraclostrobin (Pristine 38W), FRAC 7 + 11</td>
<td>8 to 10.5 oz</td>
<td>See label</td>
<td>14</td>
<td>Do not apply Pristine to Concord, Worden, Fredonia, or related grape varieties due to possible injury: REI is 12 hours; for cane work, REI is 5 days. Many combination materials (Adament, Quadris Top, Revis Top, and Luna Experience, listed on the left) can be used by themselves; however, it is better to tank mix with broad-spectrum materials such as mancozeb, captan, and sulfur in order to minimize the risk of fungicide resistance development in your field. See comments under New Shoots regarding fungicide resistance issues.</td>
</tr>
<tr>
<td></td>
<td>tebuconazole + trifloxystrobin (Adament), FRAC 3 + 11</td>
<td>3 to 7.2 oz</td>
<td>12</td>
<td>14</td>
<td>Do not make more than 6 total applications of Adament per season. Do not apply Adament to Concord grapes.</td>
</tr>
<tr>
<td></td>
<td>azoxystrobin + difenoconazole (Quadris Top), FRAC 11 + 3</td>
<td>10 to 14 oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mandipropamid, FRAC 40 + difenoconazole, FRAC 3 (Revis Top)</td>
<td>7.0 fl oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fluopyram + tebuconazole (Luna Experience) FRAC 3+7</td>
<td>5 to 8.6 fl oz 5 days for cane work</td>
<td>5</td>
<td>14</td>
<td>Do not make more than 2 sequential applications of Luna Experience or any other Group 7 or Group 3 fungicide. Please rotate to a fungicide in another group. REI is 12 hours; for cane work, REI is 5 days.</td>
</tr>
</tbody>
</table>

This is one of the most important sprays for powdery mildew, phomopsis, downy mildew, and black rot control. Clusters of many wine grape cultivars are susceptible to infection to these diseases from bloom to 4-5 weeks after bloom.

This section shows other options for management for Phomopsis, black rot, powdery mildew, and downy mildew.

In examples listed, QoI fungicides (FRAC 11) are listed. However, resistance isolates of the downy mildew and powdery mildew fungus to the QoI fungicides (Abound, Flint, Sovran, or Pristine; some people call them strebiliurins or strebiles) and the QoI component of Adament and Quadris Top are widespread in the mid-Atlantic grape growing region. Do not rely on them for downy mildew and powdery mildew control. To help avoid resistance, tank mix QoI fungicides with sulfur (but not on sulfur-sensitive varieties).

Note: metrafenone will work only against powdery mildew.
### Table 6-4. Bunch Grape Management Program

<table>
<thead>
<tr>
<th>When to Spray and Disease/Pest</th>
<th>Pesticide, Formulation, and IRAC Code</th>
<th>Amount of Formulation to Use per Acre</th>
<th>Reentry Interval (REI) (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prebloom (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downy mildew specific materials</td>
<td>Rilomil MZ, FRAC 4 + M3 or Gavel 75 DF, FRAC 22 + M3</td>
<td>2.5 lb</td>
<td>24</td>
<td>66</td>
<td>Rilomil MZ contains mfenoxam + mancozeb. Gavel 75 DF contains zoxyamide + mancozeb. Note: Use Rilomil products only when the environmental condition is strongly favoring downy mildew development. They have a very good kick-back activity; however, they are prone to have the fungicide resistance issue.</td>
</tr>
<tr>
<td></td>
<td>Rynapicide (Presido), FRAC 43</td>
<td>3 to 4 oz</td>
<td>12</td>
<td>21</td>
<td>Presidio has to be tank mixed with other broad spectrum fungicides such as mancozeb or captan.</td>
</tr>
<tr>
<td></td>
<td>mandipropamid (Revus), FRAC 40</td>
<td>8 fl oz</td>
<td>4</td>
<td>14</td>
<td>Revus products are very good protective materials for downy mildew, but they do not have any curative activity. Do not apply a crop oil within 2 weeks of a sulfur, captan, or Revus application.</td>
</tr>
<tr>
<td></td>
<td>fenamidine (Reason 50SC), FRAC 11</td>
<td>2.7 fl oz</td>
<td>12</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cyazofamid (Ramran) FRAC 21</td>
<td>2.1 to 2.75 fl oz</td>
<td>12</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>azoxystrobin + dimethomorph (Zampro) FRAC 45+40</td>
<td>11 to 14 fl oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phosphorous acid (e.g., phosphate) Prophyt, Agri-Fos, Prophylactic, etc. FRAC 33</td>
<td>Please see the label</td>
<td>4</td>
<td>0</td>
<td>Phosphite fungicides have pre- and post-symptom activity and are often recommended to be tank mixed with another downy mildew material, such as Revus or Captan. All have a 0-day PHI. Do not exceed a 0.6% spray solution concentration of Prophyt. Use higher rate of Agri-Fos in 150 to 200 gallons of water per acre late in the season when the canopy is thick. Other phosphorous acid (= phosphate) fungicides may be available. Check label for correct rates. Higher than the recommended rate can cause phytotoxicity.</td>
</tr>
<tr>
<td>Flea beetle</td>
<td>See Bud Swell recommendations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grape berry moth</td>
<td>grape berry moth is present in North Carolina, but it is not uniformly distributed in the state. If grape berry moth presence is suspected, observe flowers and fruit for injury and consider monitoring moth presence with pheromone baited traps.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>chlorantraniliprole IRAC 28 (Altacor)</td>
<td>2 to 4.5 oz</td>
<td>4</td>
<td>14</td>
<td>chlorantraniliprole IRAC 28 (Altacor)</td>
</tr>
<tr>
<td></td>
<td>methoxyfenozide, IRAC 18 (Intrepid 2F)</td>
<td>12 to 16 fl oz</td>
<td>4</td>
<td>30</td>
<td>Minimum application of Intrepid for airlast sprayers is 40 gallons per acre.</td>
</tr>
<tr>
<td></td>
<td>indoxacarb (IRAC 22) (Avaunt 30DG)</td>
<td>5 to 6 oz</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>methomyl, IRAC 1A (Lannate SP) (Lannate LV)</td>
<td>0.5 to 1 lb 1.5 to 3 pt</td>
<td>7</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spinosad, IRAC 5 (Entrust)</td>
<td>1.25 to 2.5 oz</td>
<td>4</td>
<td>7</td>
<td>Entrust is OMRI listed.</td>
</tr>
<tr>
<td></td>
<td>spinetoram, IRAC 5 (Delegeate)</td>
<td>3 to 5 oz</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fenpropimorph, IRAC 3 (Danitol 2.4 EC)</td>
<td>10.6 fl oz</td>
<td>24</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Leafhoppers/ Sharpshooters (Pierce’s Disease suppression) Initiation of foliar treatments should be based on trap captures.</td>
<td>If foliar and soil applications of group 4A pesticides are part of a management plan for Pierce’s disease (i.e., Admire Pro applied via drip and Venom foliar), at least one application of a different IRAC insecticide should occur as a rotation between these treatments. Synthetic pyrethrid insecticides (Group 3) and organophosphates (Groups 1A and 1B) are broad spectrum insecticides and have the potential to flare spider mite populations. Observe spider mites before and after treatments to determine if these populations increase.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>acetamiprid, IRAC 4A (Assail WSP)</td>
<td>2.5 oz</td>
<td>12</td>
<td>7</td>
<td>Foliar treatment</td>
</tr>
<tr>
<td></td>
<td>dinotefuran, IRAC 4A (Venom)</td>
<td>1 to 3 oz</td>
<td>12</td>
<td>1</td>
<td>Soil application</td>
</tr>
<tr>
<td></td>
<td>Venom may be applied to the soil at this time; however, only one soil application can be made per year; see label for details.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>imidacloprid, IRAC 4A (Admire Pro) (Admire Pro)</td>
<td>1 to 1.4 fl oz 3 to 4 fl oz</td>
<td>12</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Soil application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Several concentrations of imidacloprid (1.6F, 2F, 4F, and 4.6F) are available. Carefully read label to determine correct rate for target pests. Admire Pro can applied as a foliar spray or to the soil in drip or trickle or microsprinkler irrigation, as a subsurface sidedressing shanked into the root zone followed by irrigation, or a drench in sufficient water to ensure penetration into the root zone followed by irrigation. See label.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>clothianidin, IRAC 4A (Cloth)</td>
<td>1 to 2 oz</td>
<td>7</td>
<td>21</td>
<td>Soil application</td>
</tr>
<tr>
<td></td>
<td>cyfluthrin (IRAC 3) (Baythroid 2EC)</td>
<td>2.4 to 3.2 fl oz</td>
<td>12</td>
<td>3</td>
<td>Foliar treatment</td>
</tr>
<tr>
<td></td>
<td>fenpropimorph, IRAC 3 (Danitol 2.4 EC)</td>
<td>5.33 to 10.66 fl oz</td>
<td>24</td>
<td>21</td>
<td>Foliar treatment</td>
</tr>
</tbody>
</table>
Table 6-6. Bunch Grape Management Program

<table>
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<tr>
<th>When to Spray and Disease/Pest</th>
<th>Pesticide, Formulation, and IRAC, FRAC Code</th>
<th>Amount of Formulation to Use per Acre</th>
<th>Reentry Interval (REI) (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prebloom (continued)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leafhoppers/Thrips (Pierce's Disease suppression) Initiation of foliar treatments should be based on trap captures. (continued)</td>
<td>carbaryl, IRAC 1A (Sevin 80S)</td>
<td>1.25 to 2.5 lb</td>
<td>12</td>
<td>7</td>
<td>Foliar treatment</td>
</tr>
<tr>
<td></td>
<td>malathion, IRAC 1B (Malathion 75EC) (Malathion 5)</td>
<td>3 pt, 3 pt</td>
<td>12</td>
<td>3</td>
<td>Foliar treatment</td>
</tr>
<tr>
<td>Grape phylloxera (folar)</td>
<td>Grape phylloxera has root feeding and foliar feeding forms. Rootstocks used in grape propagation are resistant to root feeding forms and do not require treatment. Foliar phylloxera may be problematic in European-American hybrid varieties (i.e., Vidal, Seyval, etc.) and cause distinctive, wart-like galls on leaves. The mobile crawler stage of phylloxera is susceptible to insecticide treatment, but closed galls are not. Scouting for galls and crawlers should begin once leaves are expanded. If infested leaves are found in susceptible varieties, insecticide treatments should be timed to crawler emergence.</td>
<td>imidacloprid, IRAC 4A (Admire Pro)</td>
<td>1 to 1.4 fl oz (3 to 4 fl oz)</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>acetamiprid, IRAC 4A (Assail WSP)</td>
<td>2.5 oz</td>
<td>12</td>
<td>7</td>
<td>Foliar treatment</td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 3 (Danitol 2.4 EC)</td>
<td>5.33 to 10.66 fl oz</td>
<td>24</td>
<td>21</td>
<td>Foliar treatment</td>
</tr>
<tr>
<td>Kaolin clay (Surround WP Crop Protectant)</td>
<td>25 lb</td>
<td>4</td>
<td></td>
<td></td>
<td>Surround is a barrier that reduces insect feeding. Harvest parameters may be altered and maturity may be delayed, especially in white wine varieties. Closely monitor harvest parameters to determine optimal time to harvest. Changes in harvest parameters can affect final taste. Wine grapes sprayed up to veraison will have minimal adherence to berries. Applications after veraison will adhere more on grape berries. Surround is OMRI listed.</td>
</tr>
<tr>
<td><strong>Bloom</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thrips</td>
<td>Thrips treatment may be justified if populations exceed an average of 10 thrips per cluster. To sample for thrips, beat blossom clusters over a white surface and count the number of thrips dislodged onto the surface. Count immediately after beating the blossom cluster. Sample at least 10 blossom clusters from different locations in the vineyard. During periods of high thrips pressure, a second application may be needed, but make it only if thrips numbers remain high. Wait at least 5 days before making a second application.</td>
<td>spinetoram, IRAC 5, (Delegate)</td>
<td>3 to 5 oz</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>spinosad, IRAC 5 (Entrust 80WP)</td>
<td>1.25 to 2.5 oz</td>
<td>4</td>
<td>7</td>
<td>Foliar treatment</td>
</tr>
<tr>
<td></td>
<td>dinotefuran, IRAC 4A (Venom)</td>
<td>3 to 5 oz</td>
<td>12</td>
<td>1</td>
<td>Foliar treatment</td>
</tr>
<tr>
<td></td>
<td>azadirachtin, IRAC Unknown (Aza-Direct)</td>
<td>1 to 2 pt</td>
<td>4</td>
<td>Aza-direct is OMRI listed. Data on thrips control are limited.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pyrethrins, IRAC 3 (Pyganic 1.4 EC) (Pyganic 5 EC)</td>
<td>16 to 64 fl oz (4.5 to 18 fl oz)</td>
<td>12</td>
<td>0</td>
<td>Pyganic 1.4 EC and Pyganic 5 EC are OMRI listed. Data on thrips control are limited. Pyganic should be buffered to a pH between 5.5 and 7.</td>
</tr>
<tr>
<td><strong>Phomopsis, Black rot, Powdery mildew</strong></td>
<td>See Prebloom recommendations</td>
<td></td>
<td></td>
<td></td>
<td>A bloom spray should be made if the time interval between the last prebloom spray and the postbloom spray is more than 10 days.</td>
</tr>
<tr>
<td><strong>Botrytis specific materials</strong></td>
<td>A spray for botrytis during bloom may be beneficial in wet seasons and in vineyards with a botrytis problem. Elevate, Endura, iprodione, Inspire Super, Luna Experience, Vanguard, etc. should be rotated through the season to avoid resistance development. (Note: make sure to rotate FRAC code. Botrytis fungus is known for developing fungicide resistance.) See product labels for complete information on resistance management and use restrictions. Also, when possible, tank mix with a broad spectrum fungicide such as mancozeb, captafol, or copper.</td>
<td>iprodione (various brands), FRAC 2 75 WG or 4 F</td>
<td>1 to 1.33 lb (1 to 2 pt)</td>
<td>48</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>cyprodinil (Vanguard 75 WG), FRAC 9</td>
<td>10 oz</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fenhexamid (Elevate 50 WDG), FRAC 17</td>
<td>1 lb</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pyrimethanil (Scala SC), FRAC 17</td>
<td>18 fl oz</td>
<td>24</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>boscalid (Endura 30W), FRAC 7</td>
<td>8 oz</td>
<td>12</td>
<td>14</td>
<td>Endura, Inspire Super, and Luna Experience will also control powdery mildew.</td>
</tr>
<tr>
<td></td>
<td>difenoconazole + cyprodinil (Inspire Super) FRAC 3 + 9</td>
<td>16 to 20 fl oz</td>
<td>12</td>
<td>14</td>
<td>A fungicide with downy mildew activity must be added to Inspire Super in this spray. Do not apply more than 80 fluid ounces per acre per season.</td>
</tr>
<tr>
<td></td>
<td>fluopyram + tebuconazole (Luna Experience) FRAC 7+3</td>
<td>5 to 8.6 fl oz</td>
<td>5 days for cane work</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

Chapter VI — 2016 N.C. Agricultural Chemicals Manual
### Table 6-6. Bunch Grape Management Program

<table>
<thead>
<tr>
<th>When to Spray and Disease/Pest</th>
<th>Pesticide, Formulation, and IRAC, FRAC Code</th>
<th>Amount of Formulation to Use per Acre</th>
<th>Reentry Interval (REI) (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bloom (continued)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botrytis specific materials (continued)</td>
<td>fluopyram + pyrimethanil (Luna Tranquility) FRAC 7+9</td>
<td>12 to 24 fl oz</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cyprodinil + flu菌oxinil (Switch 62.5 EG) FRAC 9+12</td>
<td>11 to 14 oz</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Ripe rot, Bitter rot, specific materials</td>
<td>mancozeb, FRAC M3 75 DF 4 F OR captan, FRAC M4 50 W or 4 F or 80 WGD — PLUS / OR — one of the following</td>
<td>2 to 4 lb 1.6 to 3.2 qt</td>
<td>24</td>
<td>66</td>
<td>Both ripe rot and bitter rot pathogens can infecto flowers. If you have cholonic issue with either of these diseases, use mancozeb or captan at bloom, and if needed, tank-mix with a QoI fungicide.</td>
</tr>
<tr>
<td></td>
<td>azoxystrobin (Abound 2 SC), FRAC11</td>
<td>15.4 fl oz</td>
<td>4</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kresoxim-methyl (Sovran 50 WG), FRAC 11</td>
<td>4.8 oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trifloxystrobin (Flint 50 WG), FRAC 11</td>
<td>3 oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>boscalid + pyraclostrobin (Pristine 38W), FRAC 7 + 11</td>
<td>18.5 to 23 oz</td>
<td>5 to 12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td><strong>Postbloom (immediately after bloom)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European red mite, two-spotted spider mite</td>
<td>abamectin, IRAC 6 (Agri-Mek 0.15EC) (many other formulations)</td>
<td>16 fl oz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenthrin, IRAC Unknown (Aramite 50 WS)</td>
<td>1 lb</td>
<td>12</td>
<td>14</td>
<td>The reentry interval is 5 days for cane turning, tying, and girdling of table grapes. Minimum of 50 gallons per acre spray volume.</td>
</tr>
<tr>
<td></td>
<td>etoxazole, IRAC 10B (Zeal)</td>
<td>3 oz</td>
<td>12</td>
<td>28</td>
<td>Zeal is a growth regulator and kills eggs and young mites. It is most effective if applied when mite populations are low.</td>
</tr>
<tr>
<td></td>
<td>dioctyl, IRAC Unknown (Difcolol 4EC) (Keltihane 50WSP)</td>
<td>2.5 pt 2.5 lb</td>
<td>12</td>
<td>7</td>
<td>Use Keltihane at 1 pound per acre on small vines. Do not make more than 2 applications per season.</td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 21A (FujiMite 5EC)</td>
<td>2 pt</td>
<td>12</td>
<td>14</td>
<td>Do not apply more than 2 pints of FujiMite per acre per season. Apply in a minimum spray volume of 50 gallons per acre.</td>
</tr>
<tr>
<td></td>
<td>fenbutatin-oxide, IRAC 12B (Vendex 50WP)</td>
<td>2.5 lb</td>
<td>48</td>
<td>28</td>
<td>Do not make more than 2 applications of Vendex per season.</td>
</tr>
<tr>
<td></td>
<td>pyridaben, IRAC 21 (Nexter 70WPSSB) (Pyramid 60 WP)</td>
<td>5.2 oz 13.2 oz</td>
<td>12</td>
<td>7</td>
<td>The maximum amount of pyridaben allowed per acre per season is 26.4 ounces. Do not make more than two applications of pyridaben per season.</td>
</tr>
<tr>
<td></td>
<td>spirioctociflor, IRAC 23 (Envitor 25SC)</td>
<td>18 fl oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>horticultural oils, IRAC Unknown many materials, including (Saf T Side) (Glacial Spray Fluid)</td>
<td>1 to 2% by volume</td>
<td>4</td>
<td>0</td>
<td>Some oils are OMRI listed; check label. Do not use in combination with or immediately before or after spraying with fungicides such as Captan or any product containing sulfur. Do not use with carbaryl or dimecthoate. Do not use with any product whose label recommends the use of no oils. Do not use in combination with NPK foliar fertilizer applications.</td>
</tr>
</tbody>
</table>

**Grape phylloxera (foliar form)** See Prebloom recommendations.

**Phomopsis, Black rot, Powdery mildew, Downy mildew, Bitter rot, Ripe rot** See Prebloom recommendations.
### Table 6-6. Bunch Grape Management Program

<table>
<thead>
<tr>
<th>When to Spray and Disease/Pest</th>
<th>Pesticide, Formulation, and IRAC, FRAC Code</th>
<th>Amount of Formulation to Use per Acre</th>
<th>Reentry Interval (REI) (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st Cover Spray (7 to 10 days after Postbloom Spray)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phomopsis, Black rot, Powdery mildew</td>
<td>See Prebloom recommendations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grape berry moth, leafhoppers/ sharpshooters (Pierce’s Disease suppression)</td>
<td>See Prebloom recommendations</td>
<td></td>
<td></td>
<td></td>
<td>If foliar and soil applications of group 4A pesticides are part of a management plan for Pierce’s Disease (i.e., Admire Pro applied via drip and Venom foliar), at least one application of a different IRAC insecticide should occur as a rotation between these treatments. Current information indicates that in areas where Pierce’s Disease is a problem, controlling leafhoppers and sharpshooters through July reduces the risk of Pierce’s Disease. See labels for preharvest intervals.</td>
</tr>
<tr>
<td>Japanese beetle, Green June beetles</td>
<td>Do not use Japanese beetle traps. Japanese beetle foliar feed only warrants treatment if it occurs on leaves below the top trellis wire. Green June beetles only require treatment if damaging otherwise sound fruit. Green June beetles are attracted to overripe, rotting fruit. Removal of damaged fruit will help reduce Green June beetle populations.</td>
<td>acetamiprid, IRAC 4A (Assail WSP)</td>
<td>1.1 oz</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>azadirachtin, IRAC Unknown (Aza-Direct)</td>
<td>1 to 2 pt oz</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>carbaryl, IRAC 1A (Sevin XLR Plus)</td>
<td>2 qt</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fenpropathrin, IRAC 3 (Danitol 2.4 EC)</td>
<td>10.6 to 21.3 fl oz</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>malathion, IRAC 1B (Tec) (5)</td>
<td>4 lb</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>phosmet, IRAC 1B (Imidan 70W)</td>
<td>1.33 to 2.125 lb</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>kaolin clay (Surround WP)</td>
<td>26 to 50 lb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downy mildew specific material</td>
<td>See Prebloom recommendations</td>
<td></td>
<td></td>
<td></td>
<td>Note: Please keep eye on 66-day PHI for manifold. Use captan in place of mancozeb in the last half of the season.</td>
</tr>
<tr>
<td>Closing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note: Please keep eye on 66-day PHI for manifold. Use captan in place of mancozeb in the last half of the season.</td>
</tr>
<tr>
<td>Downy mildew specific material</td>
<td>See Prebloom recommendations</td>
<td></td>
<td></td>
<td></td>
<td>Note: Please keep eye on 66-day PHI for manifold. Use captan in place of mancozeb in the last half of the season.</td>
</tr>
<tr>
<td>Botrytis specific material</td>
<td>Same as Bloom Spray</td>
<td></td>
<td></td>
<td></td>
<td>See Bloom Spray for information on resistance management. Canopy management is very important for Botrytis management.</td>
</tr>
<tr>
<td>Japanese beetle, Green June beetle</td>
<td>Same as 1st Cover</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grape berry moth, Leafhopper/ sharpshooter (Pierce’s Disease suppression)</td>
<td>Same as Prebloom</td>
<td></td>
<td></td>
<td></td>
<td>Foliar applications of Group 4A insecticides should NOT be used following a long-acting soil application of any Group 4A insecticide (i.e., Admire Pro, Venom, or Clutch). Current information indicates that in areas where Pierce’s Disease is a problem, controlling leafhoppers and sharpshooters through July reduces the risk of Pierce’s Disease. See labels for preharvest intervals.</td>
</tr>
<tr>
<td><strong>2nd and Subsequent Cover Sprays (10- to 14-day intervals until the Preharvest Spray)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phomopsis, Black rot, Powdery mildew, Downy mildew</td>
<td>See Prebloom recommendations</td>
<td></td>
<td></td>
<td></td>
<td>Note: Please keep eye on 66-day PHI for manifold. Use captan in place of mancozeb in the last half of the season.</td>
</tr>
<tr>
<td>Ripe rot, Bitter rot, Macrophoma rot</td>
<td>captain 50 W or 80 WGD</td>
<td>2 to 4 lb</td>
<td>2 to 4 qt</td>
<td>1.25 to 2.5 lb</td>
<td>48 to 96</td>
</tr>
<tr>
<td>Downy mildew specific material</td>
<td>Same as Prebloom</td>
<td></td>
<td></td>
<td></td>
<td>See recommendations for downy mildew control under Prebloom above.</td>
</tr>
<tr>
<td>Phylloxera, Japanese and June beetles</td>
<td>Same as 1st Cover</td>
<td></td>
<td></td>
<td></td>
<td>Check labels for preharvest intervals.</td>
</tr>
</tbody>
</table>

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### Table 6-6. Bunch Grape Management Program

<table>
<thead>
<tr>
<th>When to Spray and Disease/Pest</th>
<th>Pesticide, Formulation, and FRAC Code</th>
<th>Amount of Formulation to Use per Acre</th>
<th>Reentry Interval (REI) (hours)</th>
<th>Preharvest Interval (PHI) (days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2nd and Subsequent Cover Sprays (10- to 14-day intervals until the Preharvest Spray)</strong> (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Current information indicates that in areas where Pierce’s Disease is a problem, controlling leafhoppers and sharpshooters through July reduces the risk of Pierce’s Disease. If Venom was applied as a soil treatment during prebloom, a second soil application is not permitted, but a foliar spray of Venom is permitted at this time. See label for further restrictions.</td>
</tr>
<tr>
<td>Grape berry moth, Leaffhopper/ sharpshooter (Pierce’s Disease suppression)</td>
<td>Same as Prebloom</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mites</td>
<td>Same as Postbloom</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grape rootworm, Southern grape rootworm</td>
<td>Grape rootworm larvae feed on roots. Adults are small, black weevils and make distinctive chain-like feeding markings on leaves. Foliar feeding does not result in yield reduction, but root feeding may reduce plant vigor over time. Treatments should be timed to adult activity, which typically peaks in June or July. Grape rootworms are sporadic pests in North Carolina and should not be treated preventively.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botrytis specific material</td>
<td>Same as Bloom Spray OR cyprodinil + fluoxastroxil (Switch 62.5 WDG), FRAC 9 + 12</td>
<td>11 to 14 oz</td>
<td>12</td>
<td>7</td>
<td>Switch may reduce the severity of sour rot. Please make sure to rotate mode of action groups against Botrytis. Insect (e.g., grape berry moth) and bird management, as well as canopy management are very important for Botrytis management.</td>
</tr>
<tr>
<td></td>
<td>See Prebloom recommendations</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note: Please keep eye on 66-day PHI for mancozeb. Use captan in place of mancozeb in the last half of the season.</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Preharvest (10 to 14 days before harvest)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botrytis specific material</td>
<td>captan, FRAC M4 50 W or 4 F or 80 WDG</td>
<td>4 lb</td>
<td>48 to 96</td>
<td>0</td>
<td>The REI for captan varies with trade name. Due to fungicide resistance issues with Botrytis, it is recommended to be tank mixed with captan, especially when risk of Botrytis is high. However, the use of captan close to harvest might influence wine quality.</td>
</tr>
<tr>
<td></td>
<td>— PLUS / OR — one of the following</td>
<td>1.25 to 2.5 lb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>iprodione (various brands), FRAC 2 50 WP or 4 F</td>
<td>1 to 2 lb</td>
<td>48</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cyprodinil (Vanguard 75 WG), FRAC 9</td>
<td>1 oz</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fenhexamide (Elevate 50 WDG), FRAC 17</td>
<td>1 lb</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pyrimethanil (Scala SC), FRAC 17</td>
<td>8 oz</td>
<td>24</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>boscalid (Endura 30W), FRAC7</td>
<td>8 oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cyprodinil + fluoxastroxil (Switch 62.5 WDG), FRAC 7 + 12</td>
<td>11 to 14 oz</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Ripe rot, Bitter rot, Macrophoma rot specific materials</td>
<td>captan, FRAC M4 50 W or 4 F or 80 WDG</td>
<td>4 lb</td>
<td>48 to 96</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— PLUS / OR — one of the following</td>
<td>1.25 to 2.5 lb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>azoxyosin (Abound 2 SC), FRAC11</td>
<td>1 oz</td>
<td>4</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kresoxim-methyl (Sorban 50 WG), FRAC 11</td>
<td>1.25 oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trifloxystrobin (Fint 50 WG), FRAC 11</td>
<td>3 oz</td>
<td>12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>boscalid + pyraclostrobin (Pristline 3BW), FRAC 7 + 11</td>
<td>18.5 to 23 oz</td>
<td>5 to 12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Downy mildew specific material</td>
<td>Phosphorous acid (e.g., phosphate) Phostrol, Agri-Fos, Prophyti, etc. FRAC 33</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>— PLUS / OR — mandipropamid (Rebus), FRAC 40</td>
<td>8 fl oz</td>
<td>4</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Please see the label</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: IRAC, FRAC Code, Formulation, and Pesticide, please see the label.*

*Note: Higher than the recommended rate can cause phytotoxicity.*
### Table 6-6. Bunch Grape Management Program

<table>
<thead>
<tr>
<th>Disease/Pest</th>
<th>Pesticide, Formulation, and IRAC, FRAC Code</th>
<th>Amount of Formulation to Use per Acre</th>
<th>Reentry Interval (REI) (hours)</th>
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<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preharvest (10 to 14 days before harvest) (continued)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powdery mildew</td>
<td>See Prebloom recommendations</td>
<td></td>
<td></td>
<td></td>
<td>Avoid the use of sulfur near harvest.</td>
</tr>
<tr>
<td>Spotted wing drosophila</td>
<td>Spotted wing drosophila (SWD) is a recently detected invasive pest of ripe and ripening fruit. It is unclear how significant SWD will be in bunch grapes. Growers are encouraged to monitor adult flies in vineyards and larvae in fruit and treat if present. Weekly or twice weekly treatments may be necessary to manage damaging populations. Insecticides effective against SWD may also have activity against leaffoppers. For more information on SWD biology, monitoring, and management, see <a href="http://www.ncsmallfruitsipm.blogspot.com">www.ncsmallfruitsipm.blogspot.com</a>.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>beta-cyfluthrin, IRAC 3A (Baythroid XL 1EC)</td>
<td>1.6 to 3.2 fl oz</td>
<td>12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 3A (Danitol 2.4EC)</td>
<td>5.33 to 21.33 fl oz</td>
<td>24</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>imidacloprid + cyfluthrin, IRAC 4A + 3 (Leverage 2.4)</td>
<td>3 to 8 fl oz</td>
<td>12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>malathion IRAC 1B (Malathion SEC)</td>
<td>1.5 pt</td>
<td>12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spinosad, IRAC 5 (Entrust)</td>
<td>1.25 to 2.5 oz</td>
<td>4</td>
<td>7</td>
<td>Enterust is OMRI listed.</td>
</tr>
<tr>
<td></td>
<td>spinetoram, IRAC 5 (Delegate)</td>
<td>3 to 5 oz</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>zeta-cypermethrin, IRAC 3 (Mustang)</td>
<td>2.15 to 4.3 fl oz</td>
<td>12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Harvest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellowjackets and bees</td>
<td>Check to make sure wasps are not nesting in vines. Spot treat or manually remove nests if present. Widespread insecticide treatment for wasps or bees is not recommended, because treatments with short PHI will not provide control, and only foraging worker wasps or bees will be killed, leaving the rest of the nest for reinfection. Damaged fruit should be removed to reduce attraction for other bees and wasps.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spotted wing drosophila</td>
<td>See Preharvest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multicolored Asian lady beetle</td>
<td>MALB can be a contaminant pest at harvest. Sample at least 10 clusters per acre within a few days of harvest, place in a plastic bag for approximately 30 minutes and count beetles. Treatment thresholds vary by variety.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>imidacloprid, IRAC 4A (Admire Pro)</td>
<td>1 to 1.4 fl oz</td>
<td>12</td>
<td>0</td>
<td>Several concentrations of imidacloprid (1.6F, 2F, 4F, and 4.6F) are available. Carefully read the label to determine the correct rate for target pests. Data on control with imidacloprid are limited.</td>
</tr>
<tr>
<td><strong>Postharvest (14- to 21-day intervals from harvest until first killing frost)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downy mildew</td>
<td>copper compounds (various formulations), FRAC M1</td>
<td>See label</td>
<td>See label</td>
<td>Premature defoliation may predispose vines to winter injury. Use shorter spray intervals when conditions are favorable for disease development. Copper may cause injury under cool, slow-drying conditions. Prophyt or Phostroil can also be used for downy mildew control.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mancozeb, FRAC M3 75 DF, 80 W or 4 F</td>
<td>2 to 4 lb 1.6 to 3.2 qt</td>
<td>24</td>
<td>Use mancozeb on copper sensitive varieties for downy mildew control.</td>
<td></td>
</tr>
<tr>
<td>Powder mildew</td>
<td>sulfur (various formulations), FRAC M2</td>
<td>See label 1.5 to 2%</td>
<td>See label</td>
<td>Use JMS Stylet Oil for powdery mildew control on sulfur sensitive varieties. Do not use captan, sulfur, or copper within 2 weeks of a JMS Stylet Oil application.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>JMS Stylet Oil, FRAC NC (See label)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grape root borer</td>
<td>mating disruption (Isomate GRB)</td>
<td>100 dispensers</td>
<td>NA</td>
<td>NA</td>
<td>Dispensers should be placed prior to the beginning of grape root borer moth flight activity and be left in the vineyard until the end of flight activity. Moth flight timing varies between vineyards, but can be as early as July and last until October. Pheromone baited traps can help determine grape root borer populations and flight activity, but traps will not be effective if mating disruption is underway.</td>
</tr>
<tr>
<td></td>
<td>Soil moundng, cultural control</td>
<td>NA</td>
<td></td>
<td>Use clean cultivation, mound soil (July 1 to Aug. 1) or at first moth emergence when using pheromone traps) or using tightly-sealed plastic mulch 3 feet from the base of vines. This practice will inhibit adult emergence from the soil when well timed. Mounded soil needs to be removed by Sept. 1.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>chloropyrifos (Lorsban Advanced) IRAC 1B</td>
<td>4.5 pt/100 gal water</td>
<td>24</td>
<td>35</td>
<td>Apply 2 quarts of mixture to soil at base of each vine. A single application should be sufficient, either pre or post harvest, depending upon grape root borer flight timing. Spray should not contact fruit or foliage. Application can be made with flat nozzles and low pressure (40 to 60 psi). The preharvest interval for Lorsban is 35 days.</td>
</tr>
</tbody>
</table>

For further information, see www.smallfruits.org.
For effective disease control, commercial growers should apply fungicides every two weeks from mid May through mid July, beginning prior to the onset of disease symptoms. Fungicides are generally not necessary in home plantings.

The Insecticide Resistance Action Committee (IRAC) groups insecticides and the Fungicide Resistance Action Committee groups fungicides into mode of action (MOA) categories. These categories are listed following the pesticide and formulation names. To reduce the risk of resistance development, avoid successive applications of products with the same MOA for the same pest. Organically acceptable insecticides (OMRI listed) are indicated in Precautions and Remarks.

Insect management differs from disease management because some insect injury can be tolerated before economic damage occurs. Apply insecticides only if potentially damaging populations are present.

Table 6-7A. Muscadine Disease Management Program

<table>
<thead>
<tr>
<th>TIMING Post(s)</th>
<th>Pesticide and Formulation</th>
<th>Amount of Formulation Per Acre</th>
<th>Restricted Entry Interval (REI)</th>
<th>Minimum Interval (Days) Between Application and Harvest; Preharvest Interval (PHI)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shoots 6 to 10 inches</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black rot, Bitter rot, Angular leaf spot, Powdery mildew</td>
<td>Azoxystrobin, FRAC 11 (Abound 2.08 SC)</td>
<td>11 to 15.4 fl oz</td>
<td>4 hrs</td>
<td>14</td>
<td>Do not make more than 2 sequential applications of strobilurin fungicides (Abound, Flint, or Pristine) before alternating with nonstrobilurin fungicides (Captan, Nova, Rally, or Topsin M).</td>
</tr>
<tr>
<td></td>
<td>Myclobutanil, FRAC 3 (Nova, Rally 40 W)</td>
<td>3 to 5 oz</td>
<td>24 hrs</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pyraclostrobin + boscalid, FRAC 11+7 (Pristine38 W)</td>
<td>8 to 12.5 oz*</td>
<td>12 hrs/5 days</td>
<td>14</td>
<td>The REI for Pristine is 12 hours for all crop uses except cane tying, cane turning or cane girdling. These operations, not normally performed on muscadines, require a five day (5d) re-entry interval. *Recommended rates; higher rates up to 23 ounces per acre can be used when disease pressure is high.</td>
</tr>
<tr>
<td></td>
<td>thiophanate-methyl, FRAC 1 (Topsin M70 WSB)</td>
<td>1 to 1.5 lb</td>
<td>48 hrs</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trifloxystrobin, FRAC 11 (Flint 50 WG)</td>
<td>2 oz</td>
<td>12 hrs</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EBDCs, FRAC M3 (Manzate Prostick, Penncozeb 75 DF, Dithane M45)</td>
<td>1.5 to 4 lb</td>
<td>24 hrs</td>
<td>66</td>
<td>Cannot be used within 66 days of harvest.</td>
</tr>
<tr>
<td><strong>Powdery mildew only</strong></td>
<td>wettable sulfur, FRAC M2 (Microthiol, other brands) 80 to 92% S</td>
<td>2 to 5 lb</td>
<td>24 hrs</td>
<td>1</td>
<td>Must be applied every 7 to 10 days. Dilute sulfur in 100 gallons of water per acre. Sulfur corrodes sprayers and trellis wires.</td>
</tr>
<tr>
<td><strong>Bloom</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black rot, Bitter rot, Angular leaf spot, Powdery mildew</td>
<td>Same as <strong>Shoots 6 to 10 inches</strong> recommendations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit rots, Sooty blotch</td>
<td>Fry is susceptible to sooty blotch.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Azoxystrobin, FRAC 11 (Abound 2.08 SC)</td>
<td>11 to 15.4 fl oz</td>
<td>4 hrs</td>
<td>14</td>
<td>Do not make more than 2 sequential applications of strobilurin fungicides (Abound, Flint, or Pristine) before alternating with nonstrobilurin fungicides (Captan, Nova, Rally, or Topsin M).</td>
</tr>
<tr>
<td></td>
<td>Captan, FRAC M4 (Captan 50 WP) (Captec 4L)</td>
<td>2 to 4 lb</td>
<td>48 hrs</td>
<td>2 (re-entry)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Captan, FRAC M4 (Captec 4L)</td>
<td>2 qt</td>
<td>48 hrs</td>
<td>2 (re-entry)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pyraclostrobin + boscalid, FRAC 11+7 (Pristine 38 W)</td>
<td>8 to 12.5 oz</td>
<td>12 hrs/5 days</td>
<td>14</td>
<td>The REI for Pristine is 12 hours for all crop uses except cane tying, cane turning or cane girdling. These operations, not normally performed on muscadines, require a five day (5d) re-entry interval.</td>
</tr>
<tr>
<td></td>
<td>Trifloxystrobin, FRAC 11 (Flint 50 WG)</td>
<td>2 oz</td>
<td>12 hrs</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td><strong>Every 2 weeks until harvest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same as sprays for BLOOM</td>
<td>Tank mix Topsin M or Nova, Rally with Captan or Captec, OR alternate Topsin M or Nova, Rally with Abound, Flint, or Pristine.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Relative Effectiveness of Various Fungicides for Muscadine Grape Disease Control

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Angular Leafspot</th>
<th>Bitter Rot</th>
<th>Powdery Mildew</th>
<th>Ripe Rot</th>
<th>Macrophoma Rot</th>
<th>Black Rot</th>
<th>Plant Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>azoxystrobin (Abound)</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>captan (Capitan, Captec)</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>myclobutanil (Nova, Rally) 40 W</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>pyraclostrobin + boscalid (Pristine)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>thiophanate sulfur (various)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>EBDCs (Manzate, Penccozeb, Dithane, others)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>sulfur (various)</td>
<td>−</td>
<td>−</td>
<td>+++</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>+++</td>
</tr>
<tr>
<td>thiophanate-methyl (Topsin M)</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>−</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>trifloxystrobin (Flint)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
</tbody>
</table>

### Muscadine Insect Management

#### Table 6-7B. Relative Effectiveness of Various Fungicides for Muscadine Grape Disease Control

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Angular Leafspot</th>
<th>Bitter Rot</th>
<th>Powdery Mildew</th>
<th>Ripe Rot</th>
<th>Macrophoma Rot</th>
<th>Black Rot</th>
<th>Plant Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>azoxystrobin (Abound)</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>captan (Capitan, Captec)</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>myclobutanil (Nova, Rally) 40 W</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>pyraclostrobin + boscalid (Pristine)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>thiophanate sulfur (various)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>EBDCs (Manzate, Penccozeb, Dithane, others)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>sulfur (various)</td>
<td>−</td>
<td>−</td>
<td>+++</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>+++</td>
</tr>
<tr>
<td>thiophanate-methyl (Topsin M)</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>−</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>trifloxystrobin (Flint)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
</tbody>
</table>

#### Table 6-7C. Muscadine Insect Management

**Aphids**

Aphids are not common pests in North Carolina muscadines and are typically only problematic in spring on new growth. Aphid populations in late summer do not typically justify treatment. Treatment is only justified when sooty mold is present or new growth is deformed.

- acetamiprid, IRAC 4A (Assail 30 SG) 2.5 oz 12 hours
- imidacloprid, IRAC 4A (Admire Pro) 1 to 1.4 fl oz 12 0 There are many formulations of imidacloprid. Read labels carefully for rate information.
- fenpropathrin, IRAC 3 (Danitol 2.4 EC) 10.66 to 21.33 fl oz 24 hours 21 Do not exceed 2.66 pints of Danitol per acre per season. Make no more than 2 applications of Danitol per season.

**Climbing Cutworms**

Scout for cutworm if damaged buds are observed. Look for cutworms at night. Cutworm treatment may be justified if greater than 4% of the buds examined are damaged and the variety does not have fruitful secondary buds. Spray in the evening if possible as cutworms are active at night. Only treat if cutworms are present.

- Bacillus thuringiensis (Bt), IRAC 11 (many formulations) rates vary 4 hours 0 Many Bt formulations are OMRI listed.
- carbaryl, IRAC 1A (Sevin XLR Plus) 1 to 2 qt 12 hours 7
- fenpropathrin, IRAC 3 (Danitol 2.4 EC) 10.66 to 21.33 fl oz 24 hours 21 Do not exceed 2.66 pints of Danitol per acre per season. Make no more than 2 applications of Danitol per season.
- flubendiamide, IRAC 28 (Belt SC) 3 to 4 fl oz 12 hours 7 Minimum application volume of 50 gpa. Do not apply more than 4 fluid ounces every 5 days or 12 fluid ounces per crop season.
- methoxyfenozide, IRAC 18 (Intrepid 2F) 12 to 16 fl oz 4 hours 30 Minimum application for airblast sprayers of 40 gpa.
- rynaxopyr, IRAC 28 (Altacor) 3 to 4.5 fl oz 4 hours 14 Use between 100-200 gallons per acre total spray volume.
- spinosad, IRAC 5 (Entrust 80WP) 2.5 oz 4 hours 7 Entrust is OMRI listed.
- spinetoram, IRAC 5 (Delegate) 3 to 5 oz 4 hours 7 days Do not exceed 5 applications of Delegate per year or 19.5 ounces per acre per crop year.

**Grape Berry Moth**

Grape berry moth is present in NC, but it is not uniformly distributed in the state. If grape berry moth presence is suspected, observe flowers and fruit for injury and consider monitoring moth presence with pheromone baited traps.

- bifenthrin, IRAC 3 (Brigade 2EC) 3.2 to 6.4 fl oz 12 hours 30
- bifenthrin + imidacloprid, IRAC 3 + 4A (Brigadier) 3.8 to 6.4 fl oz 12 hours 30
- indoxacarb, IRAC 22 (Avaunt) 5 to 6 oz 12 hours 7
- methoxyfenozide, IRAC 18 (Intrepid 2F) 12 to 16 fl oz 4 hours 30
- spinosad, IRAC 5 (Entrust 80WP) 1.25 to 2.5 oz 4 hours 7 Entrust is OMRI listed.
- phosmet, IRAC 1B (Imidan 70 WP) 1.33 to 2.125 lb 14 days 14 Do not apply more than 6.5 pounds imidan per acre per year.
- methomyl, IRAC 1A (Lannate SP) 0.5 to 1 lb 7 days 1, fresh market 14, wine
### Table 6-7C. Muscadine Insect Management

<table>
<thead>
<tr>
<th>Pest</th>
<th>Pesticide and Formulation</th>
<th>Amount of Formulation Per Acre</th>
<th>Restricted Entry Interval (REI)</th>
<th>Minimum Interval (Days) Between Application and Harvest; Preharvest interval (PHI)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grape Berry Moth (continued)</strong></td>
<td>fenpropathrin, IRAC 3 (Danitol 2.4 EC)</td>
<td>10.66 to 21.33 fl oz</td>
<td>24 hours</td>
<td>21</td>
<td>Do not exceed 2.66 pints of Danitol per acre per season. Make no more than 2 applications of Danitol per season.</td>
</tr>
<tr>
<td></td>
<td>pyrproxyfen, IRAC 7C (Esteem 0.8SEC)</td>
<td>16 fl oz</td>
<td>12 hours</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rynaxypyr, IRAC 28 (Altacor)</td>
<td>3 to 4.5 fl oz</td>
<td>4 hours</td>
<td>14</td>
<td>Use between 100-200 gallons per acre total spray volume.</td>
</tr>
<tr>
<td><strong>Grape Flea Beetle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grape fleas beetles larvage feed on developing buds during bud swell. If greater than 4% of buds observed are damaged by grape flea beetles, treatment may be justified. Apply only if damaging numbers of adult beetles are present.</td>
</tr>
<tr>
<td></td>
<td>bifenazate, IRAC 1A (Sevin XLR Plus)</td>
<td>2 qt</td>
<td>12 hours</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 3 (Danitol 2.4 EC)</td>
<td>10.66 to 21.33 fl oz</td>
<td>24 hours</td>
<td>21</td>
<td>Do not exceed 2.66 pints of Danitol per acre per season. Make no more than 2 applications of Danitol per season.</td>
</tr>
<tr>
<td></td>
<td>phosmet, IRAC 1B (Imidan 70 WP)</td>
<td>1.33 to 2.125 lb</td>
<td>14 days</td>
<td>14</td>
<td>Do not apply more than 6.5 pounds Imidan per acre per year.</td>
</tr>
<tr>
<td><strong>Grape rootworm, Southern grape rootworm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grape rootworm larvae feed on roots. Adults are small, black weevils that make distinctive chain-like feeding markings on leaves. Foliage feeding does not result in yield reduction, but root feeding may reduce plant vigor over time. Treatments should be timed to adult activity, which typically peaks in June or July. Grape rootworms are sporadic pests in North Carolina and should not be treated preventatively.</td>
</tr>
<tr>
<td></td>
<td>carbaryl, IRAC 1A (Sevin XLR Plus)</td>
<td>2 qt</td>
<td>12 hours</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><strong>Leafhoppers, Sharphooters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Leafhoppers are important vectors of Pierce’s Disease in Vinifera grapes, but Pierce’s Disease is not a common problem of muscadine grapes. Var. Carlos has been observed with Pierce’s Disease symptoms, but the disease does not appear to persist in plants over-winter. Therefore, leafhoppers should not be preventatively treated in muscadines. Large leafhopper populations may result in leaf stippling and yellowing, and populations of this size may result in economic damage and justify treatment.</td>
</tr>
<tr>
<td></td>
<td>abamectin, IRAC 6 (Agri-Mek 0.15EC, many formulations)</td>
<td>8 to 16 fl oz</td>
<td>12 hours</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>acetamiprid, IRAC 4A (Assail 30 SG)</td>
<td>2.5 oz</td>
<td>12 hours</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenazate, IRAC 3 (Brigade 2EC)</td>
<td>3.2 to 6.4 fl oz</td>
<td>12 hours</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenazate + imidacloprid, IRAC 3 + 4A (Brigadier)</td>
<td>3.6 to 6.4 fl oz</td>
<td>12 hours</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>dinotefuran, IRAC 4A (Venom)</td>
<td>1 to 3 oz</td>
<td>12 hours</td>
<td>28</td>
<td>Venom may be applied as a foliar spray at 1 to 3 ounces for to the soil at 5 to 6 ounces. See label for details.</td>
</tr>
<tr>
<td></td>
<td>clothianidin, IRAC 4A (Clutch 50 WDG)</td>
<td>6 oz</td>
<td>12 hours</td>
<td>30</td>
<td>Clutch is applied to the soil either via drip or trickle irrigation.</td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 3 (Danitol 2.4 EC)</td>
<td>5.3 to 10.6 fl oz</td>
<td>24 hours</td>
<td>21</td>
<td>Do not exceed 2.66 pints of Danitol per acre per season. Make no more than 2 applications of Danitol per season.</td>
</tr>
<tr>
<td></td>
<td>imidacloprid, IRAC 3A (ProVado 1.6 F) (Amdro Pro)</td>
<td>3 to 4 fl oz</td>
<td>12 hours</td>
<td>0 to 30</td>
<td>Provado is a foliar spray. Amdro Pro is applied to the soil and may be applied in drip or trickle or microsprinkler irrigation, as a subsurface sidedress shank into the root zone followed by irrigation, or a hill drench in sufficient water to ensure penetration into the root zone followed by irrigation. See label.</td>
</tr>
<tr>
<td></td>
<td>malathion, IRAC 1B (57 EC or Malathion 5)</td>
<td>3 pt</td>
<td>12 hours</td>
<td>3</td>
<td>Malathion may cause injury to berries if applied after bloom. Rates are based on 200 gpa spray volumes.</td>
</tr>
<tr>
<td></td>
<td>phosmet, IRAC 1B (Imidan 70 W)</td>
<td>1.33 to 2.125 lb</td>
<td>21 days</td>
<td>14</td>
<td>Do not apply more than 6.5 pounds Imidan per acre per year.</td>
</tr>
<tr>
<td></td>
<td>thiabendazole, IRAC 4A (Actara)</td>
<td>1.5 to 3.4 oz</td>
<td>12 hours</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Japanese Beetle, June Beetle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Southeastern data for Assail on Japanese beetles are limited.</td>
</tr>
<tr>
<td></td>
<td>acetamiprid, IRAC 4A (Assail 30 SG)</td>
<td>2.5 oz</td>
<td>12 hours</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenazate, IRAC 3 (Brigade 2EC)</td>
<td>3.2 to 6.4 fl oz</td>
<td>12 hours</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenazate + imidacloprid, IRAC 3 + 4A (Brigadier)</td>
<td>3.6 to 6.4 fl oz</td>
<td>12 hours</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>carbaryl, IRAC 1A (Sevin XLR Plus)</td>
<td>2 qt</td>
<td>12 hours</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 3 (Danitol 2.4 EC)</td>
<td>10.66 to 21.33 fl oz</td>
<td>24 hours</td>
<td>21</td>
<td>Do not exceed 2.66 pints of Danitol per acre per season. Make no more than 2 applications of Danitol per season.</td>
</tr>
<tr>
<td></td>
<td>imidacloprid, IRAC 3A (ProVado 1.6 F) (Amdro Pro)</td>
<td>3 to 4 fl oz</td>
<td>12 hours</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>malathion, IRAC 1B (57 EC or Malathion 5)</td>
<td>3 pt</td>
<td>12 hours</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>phosmet, IRAC 1B (Imidan 70 W)</td>
<td>1.33 to 2.125 lb</td>
<td>12 hours</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><strong>Spider Mites</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sample for mites using a minimum 10x hand lens. There is no clearly defined threshold for mites in muscadine grapes. Treatment for Vinifera grapes is recommended when greater than 50% of leaves are infested. Fast moving predatory mites can be distinguished from slower moving spider mites through direct observation. Some insecticides, such as carbaryl, can flare mite populations, and care should be used with these materials when mites are present. Rotate acaricides between MOAs to minimize selection for resistance.</td>
</tr>
<tr>
<td></td>
<td>abamectin, IRAC 6 (Agri-Mek 0.15EC, many formulations)</td>
<td>16 fl oz</td>
<td>12 hours</td>
<td>28</td>
<td>The reentry interval is 5 days for can turning, tying, and girdling. Apply in a minimum spray volume of 50 gallons per acre.</td>
</tr>
<tr>
<td></td>
<td>bifenazate, IRAC Unknown (Acramite 50 WSG)</td>
<td>1 lb</td>
<td>12 hours</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>etoxazol, IRAC 10B (Zeal)</td>
<td>3 oz</td>
<td>12 hours</td>
<td>28</td>
<td>Zeal is a growth regulator and kills eggs and young mites. It is most effective if applied when mite populations are low.</td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 21A (Portal 5EC)</td>
<td>2 pt</td>
<td>12 hours</td>
<td>14</td>
<td>Do not apply more than 2 pints of Portal per acre per season. Apply in a minimum spray volume of 50 gallons per acre.</td>
</tr>
</tbody>
</table>
**Table 6-7C. Muscadine Insect Management**

<table>
<thead>
<tr>
<th>Pest</th>
<th>Pesticide and Formulation</th>
<th>Minimum Interval (Days) Between Application and Harvest; Preharvest interval (PHI)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spider Mites (continued)</td>
<td>pyridaben IRAC 21 (Nextor 75 WSB)</td>
<td>8.8 to 10.67 oz per Acre, 12 hours, 7</td>
<td>The maximum amount of pyridaben allowed per acre per season is 26.4 ounces. Do not make more than two applications of pyridaben per season.</td>
</tr>
<tr>
<td>Grape Root Borer</td>
<td>mating disruption (Isomate GRB)</td>
<td>100 dispensers, NA, NA</td>
<td>Dispersants should be placed prior to the beginning of grape root borer moth flight activity and be left in the vineyard until the end of flight activity. Moth flight timing varies between vineyards, but can be as early as July and last until October. Pheromone baited traps can help determine grape root borer populations and flight activity, but traps will not be effective if mating disruption is underway.</td>
</tr>
<tr>
<td></td>
<td>chlorpyrifos, IRAC 1A (Lorsban Advanced)</td>
<td>4.5 pt per 100 gal, 24 hours, 35</td>
<td>Apply 2 quarts of mixture to soil at the base of each vine. Make a single application 35 days before harvest. Spray should not contact fruit or foliage. Application can be made with flood nozzles and low pressure (40 to 60 psi).</td>
</tr>
<tr>
<td>Cultivation or soil mounding</td>
<td>NA</td>
<td>NA, NA</td>
<td>Use clean cultivation, mound soil (July 1 or at first moth emergence when pheromone traps) or using tightly-sealed plastic mulch 6 feet from the base of vines. This practice will inhibit adult emergence from the soil when well timed. Mounded soil needs to be removed by Sept. 1.</td>
</tr>
</tbody>
</table>

**Red Imported Fire Ant**  
Bait treatments can effectively manage fire ants, but they typically take 2 to 4 weeks to reach full efficacy. Baits must be applied when ants are actively foraging. Test for foraging by placing food near the nest. Check for ant activity after 30 minutes.

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>Per Acre</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>pyridaben IRAC 7C (Esteem Ant Bait)</td>
<td>1.5 to 2 lb, 12 hours, 1</td>
<td>Do not exceed 0.22 pound of active ingredient per season.</td>
</tr>
<tr>
<td>methoprene MOA 7A (Extinguish Professional Fire Ant Bait)</td>
<td>1 to 1.5 lb, 4 hours, 0</td>
<td></td>
</tr>
</tbody>
</table>

**Further Information**  
Muscadine Grape Diseases and Their Control, Plant Pathology Information Note 145, [https://www.ces.ncsu.edu/depts/pp/notes/Fruit/fdin012/fdin012.htm](https://www.ces.ncsu.edu/depts/pp/notes/Fruit/fdin012/fdin012.htm)  

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**Peach and Nectarine Spray Guide**

D. F. Ritchie, Plant Pathology Extension, and J. Walgenbach, Entomology Extension

Although many pesticides are registered for disease and insect control on peaches, the following spray program lists the ones that have performed well under North Carolina conditions. The rates of pesticides recommended should give control when pest pressure is moderate to severe, assuming they are applied correctly. Where the rate is given as a range, the lower rate can be used when pest pressure is low; the higher rate should be used when pest pressure is great. Thus, the following spray program is intended to be only a guide since pest and orchard conditions can vary from orchard to orchard and year to year.

The rates given are based on the use of 200 gallons of water per acre as a dilute spray. However, 75 to 125 gallons of water per acre with the per acre rate of material used will provide optimal spray coverage for pest/disease control in most orchards. If concentrated sprays are used (less than 100 gallons of water per acre), use the amount of pesticide listed per acre.

**Note:** For imported fire ant, treat active mounds off season with directed bait formulations like Clinch, Esteem, Extinguish, and Logic. Insect growth regulators will give complete control after 30 days. Always follow label directions for best results.

**Table 6-8. Peach and Nectarine Spray Guide**

<table>
<thead>
<tr>
<th>When to Spray</th>
<th>Pest</th>
<th>Pesticide</th>
<th>Formulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dormant</td>
<td>Leaf curl</td>
<td><em>Fungicide: chlorothalonil (Bravo Weather Stik) 6 F OR ziram (Ziram) 76 DF</em></td>
<td>4 pt, 5 lb</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other chemicals registered for leaf curl include copper-containing compounds (consult labels). Copper provides adequate leaf curl control when at least 4 pounds/acre is applied before bud–swell. To control white peach scale, two dormant oil sprays 2 weeks apart are necessary. Oil will NOT control leaf curl.</td>
<td></td>
</tr>
<tr>
<td>Scale insect,</td>
<td><em>Insecticide: oil, superior type +</em></td>
<td>2 gal, 4 gal</td>
<td>Other chemicals registered for leaf curl include copper-containing compounds (consult labels). Copper provides adequate leaf curl control when at least 4 pounds/acre is applied before bud–swell. To control white peach scale, two dormant oil sprays 2 weeks apart are necessary. Oil will NOT control leaf curl.</td>
</tr>
<tr>
<td>late winter</td>
<td>rate</td>
<td><em>buprofezin (Centaur) 70WDG OR chlorpyrifos (Lorsban) 4E OR pyriproxyfen (Esteem) 35WP</em></td>
<td>25 oz, 2 pt, 4 to 5 oz</td>
</tr>
</tbody>
</table>

Addition of an insecticide with oil will improve control of scales. Where white peach scale is a problem, two applications of oil at 14- to 21-day intervals may improve control. Insecticides should be added with the second application. Application of Centaur, Esteem or Movento (see Shuck Split to Shock Fat) may be delayed to after bloom.  

*NOTE:* Heavy reliance on pyrethroid insecticides may flare scale populations, particularly San Jose scale.

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### Table 6.8: Peach and Nectarine Spray Guide

<table>
<thead>
<tr>
<th>When to Spray</th>
<th>Pest</th>
<th>Pesticide</th>
<th>Formulation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bloom</strong></td>
<td>Brown rot, blossom blight</td>
<td><strong>Fungicide:</strong> captan (Captec, Captan) 50 WP, 4L OR chlorothalonil (Bravo Weather Stik, Echo 720) 6F OR thiphosphate-methyl (Topspin M, T-Methyl) + captan (Captec, Captan) 50WP, 4L OR</td>
<td>5 lb, 2.5 qt</td>
<td>Fungicide sprays at full pink to early bloom and again at full bloom may reduce blossom blight, but another spray may be needed if bloom extends beyond 2 weeks. Demethylation inhibiting (DMI) fungicides (Elite, Indar, Nova, Orbit, Quash) are effective against blossom blight but are prone to resistance problems if used regularly. Resistance to any one of the DMI fungicides results in cross-resistance to the others. It is recommended that DMI fungicides be saved for preharvest sprays and that they not be used in bloom and cover sprays. Do not use more than one application of thiphosphate-methyl or if resistant strains are present.</td>
</tr>
<tr>
<td><strong>Petal-Fall</strong></td>
<td></td>
<td><strong>Insecticide:</strong> None</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scab, brown rot</td>
<td><strong>Fungicide:</strong> captan (Captec, Captan) 50 WP, 4L OR sulfur</td>
<td>5 lb, 2.5 qt</td>
<td>Including a fungicide at petal fall may enhance scab control.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Insecticide:</strong> beta-cyfluthrin (Baythroid) 1 EC OR esfenvalerate (Asana) 0.66 EC OR indoxacar (Avant) 30 WG OR permethrin (Permethrin, Pounce) 3.2 EC (Ambush) 25 WP OR phosmet (Imidan) 50 WP OR thiamethoxam (Actara) 25 WDG</td>
<td>2.5 oz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9 lb actual sulfur</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Insecticide:</strong> Same as in Petal-Fall</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Shuck Split to Shuck Fall</strong></td>
<td>Scab, brown rot</td>
<td><strong>Fungicide:</strong> captan (Captec, Captan) 50 WP, 4 L OR chlorothalonil (Bravo Weather Stik, Echo 720) 6F OR sulfur</td>
<td>5 lb, 2.5 qt</td>
<td>Very critical period for start of scab control. Tank-mix of thiophanate-methyl. 0.75 pound a.i. acre (Topsin M, T-Methyl) with captan or sulfur first two sprays enhances scab control. Chlorothalonil cannot be used later than shuck split.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 pt</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Insecticide:</strong> Same as in Petal-Fall</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cover Sprays</strong></td>
<td>Scab, brown rot</td>
<td><strong>Fungicide:</strong> Same as SHUCK SPLIT</td>
<td></td>
<td>First through third cover sprays are very important for scab control on peach. Chlorothalonil used at shuck split can give 3 weeks of scab control. NOTE: Chlorothalonil cannot be used after the shuck split spray.</td>
</tr>
<tr>
<td>Begin 7 to 10 days after shuck fall</td>
<td>Plum curculio, Stink bugs, Oriental fruit moth</td>
<td><strong>Insecticide:</strong> beta-cyfluthrin (Baythroid) 1 EC OR esfenvalerate (Asana) 0.66 EC OR fenpropathrin (Danitol) 2.4 EC OR indoxacar (Avant) 30 WG OR methomyl (Lannate) 2.4 L OR permethrin (Permethrin, Pounce) 3.2 EC (Ambush) 2.0 EC OR phosmet (Imidan) 50 WP OR spinetoram (Delegate) 25WDG OR chlorantraniliprole (Altacor) 35WDG</td>
<td>2.5 fl oz</td>
<td>Do NOT apply esfenvalerate or permethrin within 2 weeks of harvest.</td>
</tr>
<tr>
<td>continue 10 to 14 days, stopping at least 2 weeks before harvest</td>
<td></td>
<td></td>
<td>11.6 fl oz</td>
<td>Do NOT apply more than 42 2/3 fluid ounces Danitol per acre per season or within 3 days of harvest. Do NOT make more than four applications of Avant per season.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16 fl oz</td>
<td>Do NOT apply more than one application of thiophanate-methyl or if resistant strains are present.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6 fl oz</td>
<td>Do NOT apply phosmet within 3 weeks of harvest.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 oz</td>
<td>Delegate and Altacor are primarily for Oriental fruit moth control.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 oz</td>
<td>In most orchards treated with oil and a scale-active insecticide before bloom, additional control measures are usually not necessary. However, in orchards with a history of San Jose scale, targeting first generation crawlers at the second or third cover spray will help to minimize the potential for damage.</td>
</tr>
</tbody>
</table>

### Chapter VI — 2016 N.C. Agricultural Chemicals Manual
<table>
<thead>
<tr>
<th>When to Spray</th>
<th>Pest</th>
<th>Pesticide</th>
<th>Formulation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preharvest Begin 2 to 3 weeks before harvest; apply fungicides at 7- to 10-day intervals. In periods of high disease pressure, closer spray intervals may be necessary.</td>
<td>Brown rot</td>
<td>Fungicide: azoxystrobin (Abound) 2.08 F OR azoxystrobin + difenoconazole (Quadris Top) 2.71SC OR difenoconazole + cyprodinil (Inspire Super) 2.82EW OR fenbuconazole (Indar) 75 WSP OR metconazole (Quash) 50 WDG OR penthiopyrad (Fontelis) 1.67SC OR propiconazole (Bumper, Orbit, PropiMax) 3.6 EC OR pyraclostrobin + boscalid (Pristine) 38 WG OR pyraclostrobin+fluxapyroxad (Merivon) 500 SC OR tebuconazole (Elite, Orius, Tebuzol) 45 DF OR tebuconazole + trifloxystrobin (Adament) 50 WG</td>
<td>12 to 15 fl oz Per 100 Gal OR 16 to 20 fl oz Per Acre</td>
<td>NOTE: Check product label for any preharvest interval (PHI) or reentry interval (REI) times and other restrictions. azoxystrobin (PHI = 0 day, RE = 4 hr) azoxystrobin+difenoconazole (PHI =0 day,REI=12 hr) difenoconazole + cyprodinil (PHI=2 days, REI=12 hr) fenbuconazole (PHI = 0 day, REI = 12 hr) metconazole (PHI =14 days, REI = 12 hr) penthiopyrad (PHI=0 day, RE=12 hr) propiconazole (PHI = 0 day, REI = 24 hr) pyraclostrobin + boscalid (PHI= 0 day, REI= 12 hr) pyraclostrobin+fluxapyroxad (PHI=0 day, REI=12 hr) tebuconazole (PHI = 0 day, REI = 12 hr) Preharvest use of propiconazole, azoxystrobin + difenoconazole, and difenoconazole + cyprodinil, is limited to 2 applications. Do not make more than 2 sequential applications of these fungicides before alternating with a fungicide having a different mode of action.</td>
</tr>
<tr>
<td></td>
<td>Rhizopus rot</td>
<td>dichloran (Botran) 75 WP</td>
<td>3 lb</td>
<td>10-day preharvest interval.</td>
</tr>
<tr>
<td></td>
<td>June beetle, Japanese beetle</td>
<td>Insecticide: carbaryl (Sevin) 80 WSP OR imidaclorprid (Admire Pro) 4.6SC</td>
<td>1.25 lb OR 1.4 fl oz</td>
<td>Do NOT apply Sevin less than 3 days before harvest. Admire has a 0-day preharvest interval, but a 12-hour re-entry interval.</td>
</tr>
<tr>
<td>Borer Spray</td>
<td>Peachtree borer</td>
<td>Insecticide: chlorpyrifos (Lorsban) 4 EC OR esfenvalerate (Asana) 0.66 EC</td>
<td>3 qt OR 5.8 oz</td>
<td>Tree trunks and limbs should be sprayed to drip, after harvest or after August 1, whichever comes last. Best control results when applied the week of September 1.</td>
</tr>
<tr>
<td>Special Spray</td>
<td>Spider mile</td>
<td>Miticide: Preventive Spray: hexythiazox (Savey) 50 DF OR diflubenzuron (Apollo) SC</td>
<td>3 to 6 oz OR 4 to 8 oz</td>
<td>Apollo and savey are ovicides and should be applied early in the season. Apollo and Savey have the same mode of action, so if resistance develops to one compound, populations will be resistant to both products. Do not apply more than once per year, and preferably use once every other year.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Curetive Spray: bifenthrin (Acrari fame) 50 WP OR abamectin (Agri-Mek) 0.7SC</td>
<td>1 lb OR 0.5 to 1.0 fl oz</td>
<td>Do not apply within 3 days of harvest. Include 0.25% horticultural oil (not dormant oil) or a nonionic surfactant with Agri-Mek. 21 day PHI.</td>
</tr>
</tbody>
</table>
## Table 6-9. Relative Effectiveness and Safety of Various Insecticides for Peach Insects

<table>
<thead>
<tr>
<th>Insecticide Formulation and Rate per 100 Gallons Water</th>
<th>Days Between Last Spray and Harvest</th>
<th>Plum Curculio</th>
<th>Oriental Fruit Moth</th>
<th>Peachtree Borer</th>
<th>Catfacing Insects (stink bugs)</th>
<th>Scales (White Peach, San Jose)</th>
<th>Beetles (June, Japanese)</th>
<th>Safety*</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetamiprid (Assail 30 SG) 7 oz **</td>
<td>7</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>Caution</td>
</tr>
<tr>
<td>buprofezin (Centaur 70WSB) 17 oz **</td>
<td>14</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Caution</td>
</tr>
<tr>
<td>beta-cyfluthrin (Baythroid XL) 1 oz **</td>
<td>7</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>Warning, restricted</td>
</tr>
<tr>
<td>carbaryl (Sevin 80 SP) 1.25 lb **</td>
<td>3</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>Caution</td>
</tr>
<tr>
<td>chlorantraniliprole (Altacor 35WDG) 2.5 oz **</td>
<td>10</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Caution</td>
</tr>
<tr>
<td>chlorpyrifos (Lorsban 4.0 EC) 3 qt **</td>
<td>Prebloom and postharvest only</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Danger, Restricted</td>
</tr>
<tr>
<td>dinotefuran (Scorpion 35SL) 5.25 oz ** (Vendom 70SG) 4 oz **</td>
<td>3</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>Caution</td>
</tr>
<tr>
<td>esfenvalerate (Asana 0.66 EC) 5.8 oz **</td>
<td>14</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>—</td>
<td>+++</td>
<td>—</td>
<td>Warning, Restricted</td>
</tr>
<tr>
<td>fenpropatrin (Danitol 2.4 EC) 16 oz **</td>
<td>3</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>—</td>
<td>+++</td>
<td>—</td>
<td>Warning, Restricted</td>
</tr>
<tr>
<td>gamma-cyhalothrin (Proaxis 0.5EC) 3.8 oz **</td>
<td>14</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>—</td>
<td>+++</td>
<td>—</td>
<td>Warning, Restricted</td>
</tr>
<tr>
<td>imidaclorpid (Provado 1.6F) 0.3 oz **</td>
<td>0</td>
<td>*</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Caution</td>
</tr>
<tr>
<td>indoxacarb (Avaunt 30 WG) 3 oz **</td>
<td>14</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>Warning, Restricted</td>
</tr>
<tr>
<td>lambda-cyhalothrin (Karat 2.08CS) 1.9 oz **</td>
<td>14</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>—</td>
<td>+++</td>
<td>—</td>
<td>Caution</td>
</tr>
<tr>
<td>methomyl (Lannate 2.4 L) 1 pt **</td>
<td>4</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+</td>
<td>Danger, Restricted</td>
</tr>
<tr>
<td>oil superior — 2 gal</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Caution</td>
</tr>
<tr>
<td>permethrin (Pounce 2.0 EC, 25 WP) 6 oz **</td>
<td>7</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>—</td>
<td>+++</td>
<td>Warning, restricted</td>
</tr>
<tr>
<td>phosmet (Imidan 50 WP) 1.5 lb **</td>
<td>14</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>Warning</td>
</tr>
<tr>
<td>pyriproxyfen (Esteem 35 WP) 5 oz **</td>
<td>14</td>
<td>*</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Caution</td>
</tr>
<tr>
<td>spinetoram (Delegate 25WDG) 2.5 oz **</td>
<td>7</td>
<td>*</td>
<td>+++</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>+</td>
<td>Caution</td>
</tr>
<tr>
<td>Spirotetramat (Movento 2SC) 8 oz **</td>
<td>7</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>+++</td>
<td>—</td>
<td>Caution</td>
</tr>
<tr>
<td>thiamethoxam (Actara 25WDG) 2.5 oz **</td>
<td>14</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>Caution</td>
</tr>
</tbody>
</table>

* Relative Toxicity (Safety):
  
  Danger = most toxic to man
  Caution = least toxic to man
  Restricted = restricted use compound; may be applied only by licensed pesticide operators
Relative Effectiveness of Chemicals for Disease Control on Peaches and Nectarines

D. F. Ritchie, Plant Pathology Extension

(E = excellent; G = good; F = Fair; P = poor; NC = no control; NA = not applicable; ND = no data)

Table 6-10. Relative Effectiveness of Chemicals for Disease Control on Peaches and Nectarines

<table>
<thead>
<tr>
<th>Fungicide/Bactericide and Rate per Acre per 100 gallons</th>
<th>FRAC Code</th>
<th>Days Between Last Spray and Harvest</th>
<th>Reentry Interval (REI)* (hours)</th>
<th>Leaf Curl</th>
<th>Blossom Blight</th>
<th>Brown Rot</th>
<th>Peach Scab</th>
<th>Bacterial Spot</th>
</tr>
</thead>
<tbody>
<tr>
<td>azoxystrobin (Abovent) 2.08 F.—12 fl oz</td>
<td>11</td>
<td>0</td>
<td>4</td>
<td>NA</td>
<td>F-G</td>
<td>G</td>
<td>NA</td>
<td>NC</td>
</tr>
<tr>
<td>azoxystrobin + difenoconazole (QuaDro) 2,7:1SC — 14 fl oz</td>
<td>11, 3</td>
<td>0</td>
<td>12</td>
<td>NA</td>
<td>G-E</td>
<td>G-E</td>
<td>G</td>
<td>NC</td>
</tr>
<tr>
<td>captan (Captain, Captec) 50 WP, 4L—Stb, 2.5 qt</td>
<td>M4</td>
<td>0</td>
<td>24 to 96</td>
<td>NA</td>
<td>F-G</td>
<td>G</td>
<td>NA</td>
<td>NC</td>
</tr>
<tr>
<td>chlorothalonil (Bravo Weather Stik, Echo 720) 6 F.—4 pt</td>
<td>M5</td>
<td>NA</td>
<td>12**</td>
<td>G</td>
<td>F-G</td>
<td>NA</td>
<td>G</td>
<td>NC</td>
</tr>
<tr>
<td>copper 3000; Cuprofix ULTRA 40D) — 4 to 8 lb ***</td>
<td>M1</td>
<td>at least 21</td>
<td>12 to 24</td>
<td>F-G</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>G</td>
</tr>
<tr>
<td>cyprodinil (Vanguard) 75 WP—5 oz</td>
<td>9</td>
<td>NA</td>
<td>12</td>
<td>NA</td>
<td>G</td>
<td>NA</td>
<td>NA</td>
<td>NC</td>
</tr>
<tr>
<td>difenoconazole + cyprodinil (Inspec Super) 2.82EW — 20 fl oz</td>
<td>3, 9</td>
<td>2</td>
<td>12</td>
<td>NA</td>
<td>G-E</td>
<td>G-E</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>fenbuconazole (Incan) 75 WSP—2 oz</td>
<td>3</td>
<td>0</td>
<td>12</td>
<td>NA</td>
<td>G</td>
<td>G</td>
<td>P-F</td>
<td>NC</td>
</tr>
<tr>
<td>fenhexamid (Elevate) 50 WDG—1.5 lb</td>
<td>17</td>
<td>0</td>
<td>12</td>
<td>NA</td>
<td>ND</td>
<td>F</td>
<td>P-F</td>
<td>NC</td>
</tr>
<tr>
<td>iprodione (Rovral)—1.5 lb, 1.5 pt</td>
<td>2</td>
<td>NA</td>
<td>12</td>
<td>NA</td>
<td>ND</td>
<td>F</td>
<td>P-F</td>
<td>NC</td>
</tr>
<tr>
<td>metconazole (Quash) 50WDQ</td>
<td>3</td>
<td>14</td>
<td>12</td>
<td>NA</td>
<td>G</td>
<td>G</td>
<td>F</td>
<td>NC</td>
</tr>
<tr>
<td>myclobutanil (Rally40) WP—4 oz</td>
<td>7</td>
<td>0</td>
<td>24</td>
<td>NA</td>
<td>G</td>
<td>F</td>
<td>NC-P</td>
<td>NC</td>
</tr>
<tr>
<td>oxytriazine (FireLine, Mycosheild) 17 WP—0.75 lb</td>
<td>41</td>
<td>21</td>
<td>12</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>F-G</td>
</tr>
<tr>
<td>penthoxyrid (Fontelo) 1.67SC 20 fl oz</td>
<td>11</td>
<td>7</td>
<td>12</td>
<td>NA</td>
<td>G</td>
<td>G</td>
<td>E</td>
<td>NC</td>
</tr>
<tr>
<td>propiconazole (Bumper, Orbit, PropMax) 3.6 EC—4 fl oz</td>
<td>3</td>
<td>0</td>
<td>24</td>
<td>NA</td>
<td>G</td>
<td>G</td>
<td>NC-P</td>
<td>NC</td>
</tr>
<tr>
<td>pyraclostrobin + boscalid (Pristine) 38 WG—10.5 to 14.5 oz</td>
<td>11, 7</td>
<td>0</td>
<td>12</td>
<td>NA</td>
<td>G</td>
<td>G-E</td>
<td>F</td>
<td>NC</td>
</tr>
<tr>
<td>pyraclostrobin + fluazinorm (Merizon) 500SC—6.8 fl oz</td>
<td>7</td>
<td>1</td>
<td>12</td>
<td>NA</td>
<td>G</td>
<td>G</td>
<td>E</td>
<td>NC</td>
</tr>
<tr>
<td>pymethchnal (Scala SC) 60 SC—1 pt</td>
<td>9</td>
<td>2</td>
<td>12</td>
<td>NA</td>
<td>ND</td>
<td>P-F</td>
<td>ND</td>
<td>NC</td>
</tr>
<tr>
<td>sulfur—9 lb actual sulfur</td>
<td>M2</td>
<td>0</td>
<td>24</td>
<td>NA</td>
<td>P-F</td>
<td>P</td>
<td>F-G</td>
<td>NC</td>
</tr>
<tr>
<td>tebuconazole (Elite, Oris, Tebuazol) 45 DF, WP—4 oz</td>
<td>3</td>
<td>0</td>
<td>12</td>
<td>NA</td>
<td>G</td>
<td>G</td>
<td>P</td>
<td>NC</td>
</tr>
<tr>
<td>tebuconazole + trifloxystrobin (Adament) 50WG</td>
<td>3, 11</td>
<td>1</td>
<td>24</td>
<td>NA</td>
<td>G</td>
<td>P</td>
<td>P-F</td>
<td>NC</td>
</tr>
<tr>
<td>thionaphate-methyl (Topan M) 70 WP, 4.5FL—1 lb, 1.5 pt + captan (Captain) 50 WP—4 lb</td>
<td>1, M4</td>
<td>1</td>
<td>12</td>
<td>24 to 96</td>
<td>NA</td>
<td>G</td>
<td>F-G</td>
<td>G</td>
</tr>
<tr>
<td>ziram (Ziram) 76 DF—5 lb</td>
<td>M3</td>
<td>14</td>
<td>48</td>
<td>G</td>
<td>P</td>
<td>P</td>
<td>P-F</td>
<td>P</td>
</tr>
</tbody>
</table>

* REI = reentry interval. Hours between last spray and reentry without using personal protective equipment. This time interval can vary depending on product formulation, always consult label of product being used.
** Consult chlorothalonil label for REI precautions related to risk of eye injury.
*** Rate of copper stated is for dormant spray.
**** Rovral is not registered for use after bloom.
FRAC (Fungicide Resistance Action Committee) Codes – fungicides having the same code have a similar mode of action and thus are not appropriate mixing or alternating partners for use in resistance management.

Nematode Control on Peaches
D. F. Ritchie, Plant Pathology Extension

Preplant Soil Fumigation — In light, sandy soil where root-knot and ring nematodes are present, preplant soil fumigation is imperative. If the nematode assay indicates the presence of root-knot or ring nematodes, it may be advantageous to fumigate the entire orchard site in October to mid-November before planting the trees in late winter to early spring. If the nematode assay does not indicate the presence of root-knot or ring nematodes, an 8- to 10-foot strip to be used for the tree row may be fumigated.

Table 6-11. Preplant Soil Fumigation

<table>
<thead>
<tr>
<th>Materials</th>
<th>Rate/treated acre*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3 dichloropropene (Telone II) OR metam-sodium (Vapam, Sectagon II, Busan 1020) tarped</td>
<td>27 to 36 gallons</td>
</tr>
<tr>
<td>Metasodium</td>
<td>75 to 100 gallons</td>
</tr>
</tbody>
</table>

* Rate will vary depending on soil type. Follow manufacturer’s directions for rate and application procedures.

Postplant Treatment (Bearing and Nonbearing Trees) — NO MATERIALS REGISTERED for postplant use.

Further Information
Southeastern Peach Growers’ Handbook (http://www.ent.uga.edu/peach/peachhbk/toc.htm)
Chapter VI — 2016 N.C. Agricultural Chemicals Manual

Strawberry Disease Control

F. J. Louws, Plant Pathology Extension

For more information and details, see the Southeast Regional Strawberry Integrated Management Guide, which is online at http://www.smallfruits.org/SmallFruitsRegGuidel.

Table 6-12A. Pre-Planting Disease Control

<table>
<thead>
<tr>
<th>Pest/Problem</th>
<th>Management Options</th>
<th>Effectiveness (+) or Importance (*)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracnose</td>
<td></td>
<td>++++++</td>
<td>Use of certified plants or plants produced in a similarly stringent program is the most important method to prevent these diseases.</td>
</tr>
<tr>
<td>Angular leaf spot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phytophthora crown rot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fusarium crown rot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viruses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nematodes and soilborne pathogens</td>
<td>Sample soil</td>
<td>***</td>
<td>Sample soils for nematode analysis through local state services to determine which fumigant or IPM management plan may be required</td>
</tr>
<tr>
<td>Crop rotation and cover crop selection</td>
<td></td>
<td>*** +++</td>
<td>Selected summer cover crops and rotating fields to other crops for 2 to 3 years can suppress nematode populations and reduce black root rot and other soilborne disease problems.</td>
</tr>
<tr>
<td>Weeds</td>
<td>Pre-plant fumigation and laying down plastic mulch</td>
<td>++++</td>
<td>See fumigation table below. Consult with custom applicators and/or Extension agents for product and rate recommendations.</td>
</tr>
<tr>
<td>Root and crown rot disorders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Black root rot; Phytophthora crown rot)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6-12B. Relative Efficacy of Currently Registered Fumigants or Fumigant Combinations for Managing Soilborne Nematodes, Diseases, and Weeds 1,2

Fumigants: New 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 see http://www2.epa.gov/soil-fumigants. Some fumigants are registered on multiple crops but with crop- or soil-type-specific rates; others are registered for specific crops and/or in certain states only. Follow all labels carefully.

<table>
<thead>
<tr>
<th>Product</th>
<th>Rate per Broadcast Acre 3</th>
<th>Nematodes</th>
<th>Disease</th>
<th>Nutsedge</th>
<th>Weeds: Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telone ii (1,3-D)</td>
<td>9 to 12 gallons</td>
<td>++++</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Telone C17 (1,3-D + chloropicrin)</td>
<td>32.4 to 42 gallons</td>
<td>++++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Telone C35 (1,3-D + chloropicrin)</td>
<td>39 to 50 gallons</td>
<td>++++</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Telone C35 + VIF4</td>
<td>See comments below</td>
<td>++++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>InLine (1,3-D + chloropicrin)2</td>
<td>29 to 38.4 gallons</td>
<td>++++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Metam sodium4 (MS)</td>
<td>37.5 to 75 gallons</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Metam potassium4</td>
<td>30 to 60 gallons</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Chloropicrin5</td>
<td>150 to 350 pounds</td>
<td>+</td>
<td>+++</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Plo-Chlor 60 (chloropicrin + 1,3-D)</td>
<td>19.5 to 31.5 gallons</td>
<td>++++</td>
<td>+</td>
<td>+++</td>
<td></td>
</tr>
<tr>
<td>Chloropicrin + MS</td>
<td>19.5 to 31.5 gallons + 37.5 to 75 gallons</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Paladin (dimethyl disulphide) should be formulated with 21% chloropicrin + VIF7</td>
<td>35.0 – 51.3 gallons</td>
<td>++++</td>
<td>++++</td>
<td>+++</td>
<td>+++^3</td>
</tr>
<tr>
<td>Dominus (allyl isothiocyanate)6</td>
<td>25 to 40 gallons</td>
<td>++^6</td>
<td>+++^5</td>
<td>+^6</td>
<td>+++^5</td>
</tr>
</tbody>
</table>

1 Each of the fumigants listed in this table has performed well in regional trials. Some alternative fumigants may need to be complemented with herbicides or hand weeding, depending on weed pressure. Dominus was recently registered but there is limited experience with the product through University or independent trials in our region; therefore growers may want to consider this on an experimental basis. Telone can persist more than 21 days under cool or wet soil conditions.
2 Refer to the Herbicide Recommendation section of this guide for directions pertaining to herbicide applications. Fumigants with low efficacy against weeds require a complementary herbicide program.
3 InLine is formulated for application through drip lines; efficacy is dependent on good distribution of the product in the bed profile.
4 Metam sodium can be Vapam, Sectagon 42, Metam CLR or other registered formulations; metam potassium can be Metam KLR, K-Pam, Sectagon K54 or other registered formulations. Metam potassium should be used in soils with high sodium content.
5 Reduced rates can be used with virtually impermeable film (VIF).
6 Chloropicrin is available in multiple formulations and labels including an EC formulation for applications through drip irrigation systems.
7 Paladin has low efficacy on certain small seeded broadleaf weeds and grasses; Paladin is not registered in all States. Paladin is also available in an EC formulation for application through drip irrigation systems.
8 Dominus was recently registered but there is limited experience with the product through University or independent trials in our region; therefore growers may want to consider this on an experimental basis. Plant back time is 10 days. The active ingredient allyl isothiocyanate is most similar to the active breakdown ingredient of Vapam (methyl isothiocyanate) and is likely to behave in a similar manner with a similar pest control profile.
Planting and Early Post-Planting: Disease Control

FRAC/IRAC/HRAC codes — These acronyms refer to industry-sponsored committees addressing resistance to crop protection materials; Fungicide Resistance Action Committee (FRAC), Insecticides Resistance Action Committee (IRAC) and Herbicide Resistance Action Committee (HRAC). Pesticides affect their target pest in a variety of ways, and the way a pesticide kills the target organism is called the mode of action (MoA). Although pesticides have different names and may have different active ingredients, they may have the same MoA. Over time, pests can become resistant to a pesticide, and typically this resistance applies to all pesticides with the same MoA. When rotating pesticides, it is important to select pesticides with different MoAs. The FRAC/IRAC/HRAC have grouped crop protection materials into groups with shared MoAs and given them numerical designations, which appear on pesticide labels. The code UN means the MoA is unknown. When selecting pesticides, avoid successive applications of materials in the same MoA group to minimize potential resistance development. More information about this topic can be found at www.irac-online.org, www.frac.info and www.HRACglobal.com.

Organic Materials Review Institute (OMRI) listed materials are acceptable for production systems certified as organic. Organically acceptable materials (OMRI listed) are in the Comments section.

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.

Pre-plant dips: Several products are registered for 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 or Azaka — Mix 5 to 8 fluid ounces per 100 gallons of water. Dip plants for 2 to 5 minutes. 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 bacterial angular leaf spot and other diseases. It is reasonable to expect Abound 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, and 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 — Switch offers options for treating plants known to be infected with Colletotrichum species and has shown good efficacy in reducing losses due to the crown rot pathogen in bare root transplants (Colletotrichum gloeosporioides). Use 5 to 8 fluid ounces per 100 gallons of 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 minutes. 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.

Phosphites — Dip plants in 2.5 pounds per 100 gallons (Aliette), 2 pints per 100 gallons (ProPhyt), or 2.5 pints per 100 gallons (Phostrol) for 15 to 30 minutes and then plant within 24 hours after treatment. This treatment should help to suppress Pythium and Phytophthora problems.

Products like Oxidate are registered for plant dip use. However, little data are available, and it is doubtful that they would offer management of root diseases. In most cases, root pathogens are internal to the tissue and these products are primarily surface disinfectants.

The * and ** noted in the management option columns below throughout the disease control section refer to the following fungicide resistance management recommendations:

* Botrytis cinerea historically has a high potential to develop resistance, and recent data suggest a high percentage of strains resistant to several important fungicides. Therefore, it is important to give these recommendations serious consideration:
  1. Limit the number of times fungicides of the same class are applied in 1 year.
  2. Tank-mix a benzimidazole (Topsin-M) fungicide with a broad spectrum fungicide such as Captan or Thiram. Topsin-M does not have Botrytis activity due to resistance but is helpful for several early season foliar diseases if present.

** It is currently suggested that the strobilurin (now called QoI or group 11) fungicides (Abound, Azaka, Cabrio, Pristine, and Quadris Top) be saved for use in controlling anthracnose diseases when there is a high potential for disease pressure. Captan or Thiram should help to suppress anthracnose when utilized in Botrytis or other disease control applications, but the QoI materials are currently the most efficacious materials for control of anthracnose. Some of these QoI materials 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 QoIs 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 QoIs; make sure to follow all resistance management guidelines. Recently, we have documented reduced activity with azoxystrobine (Abound, Azaka) with certain strains of the anthracnose fruit rot (AFR) pathogen. Cabrio or Pristine has offered better control of AFR in recent research efforts.
Chapter VI — 2016 N.C. Agricultural Chemicals Manual

**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. Certain fungicides such as the QoI materials and Protocol are registered for powdery mildew, but are not recommended due to resistance selection.

**Anthracnose** — Most plantings are not at risk for anthracnose. Thus, anthracnose fungicides may not be needed. In most cases, contaminated plant sources are identified before or soon after planting. Know your plant source. If present, anthracnose on plants can appear to cause significant damage and may not reappear in the spring.

### Table 6-13A. Planting and Early Post-Planting: Disease Control

<table>
<thead>
<tr>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness (+) or Importance (*)</th>
<th>REI</th>
<th>PHI</th>
<th>Comments (FRAC/IRAC Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Red stele; Phytophthora crown/root rots</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mefenoxam (Ridomil Gold SL)</td>
<td>1.0 pt</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>Apply in sufficient water in drip applications to move the fungicide into the root zone. Use proportionately less Ridomil Gold for band treatments. Do not exceed 1.5 quart/year. FRAC–4</td>
</tr>
<tr>
<td>mefenoxam (Ultra Flourish)</td>
<td>2.0 pt</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>Apply in sufficient water to move the fungicide into the root zone. Use proportionately less mefenoxam for band treatments. Do not exceed 6 pints/year. FRAC–4</td>
</tr>
<tr>
<td>metalaxyl (MetaStar and generics)</td>
<td>2 qt/treated acre</td>
<td>+++</td>
<td>48 hr</td>
<td>0 days</td>
<td>Apply in sufficient water to move the fungicide into the root zone. Do not exceed 6 qt/treated Acre. FRAC–4</td>
</tr>
<tr>
<td>phosphites, e.g., Ailette ProPhyt, Phostrol</td>
<td>Various rates; see label.</td>
<td>++</td>
<td>12 hr</td>
<td>0 days</td>
<td>The 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. FRAC–33</td>
</tr>
<tr>
<td><strong>Anthracnose ('acutatum')</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pristine WG**</td>
<td>18.5 to 23 oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>Premix of two active ingredients, thiophanate-methyl (FRAC–1) and propiconazole (FRAC–3). No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action.</td>
</tr>
<tr>
<td>Cabrio 20 EG**</td>
<td>12 to 14 oz</td>
<td>+++</td>
<td>24 hr</td>
<td>0 days</td>
<td>Failure in management of some ‘acutatum’ populations has been observed with Abound and similar products. FRAC–11</td>
</tr>
<tr>
<td>Abound FL** Azaka</td>
<td>6.2 to 15.4 fl. oz</td>
<td>+++</td>
<td>4 hr</td>
<td>0 days</td>
<td>Premix of two active ingredients, thiophanate-methyl (FRAC–1) and propiconazole (FRAC–3). No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action.</td>
</tr>
<tr>
<td>Tilt and multiple generics</td>
<td>4 fl oz</td>
<td>+++</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. FRAC–3</td>
</tr>
<tr>
<td>Quadrin Top</td>
<td>12 to 14 fl oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>Premix of two active ingredients, azoxystrobin (FRAC–11) and difenoconazole (FRAC–3). No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action.</td>
</tr>
<tr>
<td>Protocol</td>
<td>1.33 qt</td>
<td>+++</td>
<td>24 hr</td>
<td>1 day</td>
<td>Premix of two active ingredients, thiophanate-methyl (FRAC–1) and propiconazole (FRAC–3). No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action.</td>
</tr>
</tbody>
</table>
### Table 6-13A. Planting and Early Post-Planting: Disease Control

<table>
<thead>
<tr>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness (+) or Importance (*)</th>
<th>REI</th>
<th>PHI</th>
<th>Comments (FRAC/IRAC Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anthraxnose (‘gloeosporioides’ crown rot)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captain 50W or Captain 80WDG or</td>
<td>3 to 6 lb (50W) or 1.9 to 3.8 lb (80WDG)</td>
<td>++</td>
<td>24 hr</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td><strong>Botrytis crown rot</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rally 4F and generics</td>
<td>1.5 to 2 pt</td>
<td>+++</td>
<td>24 hr</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>or prodione</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch 62.5 WG*</td>
<td>11 to 14 oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>FRAC-12, FRAC-9</td>
</tr>
<tr>
<td>or Iprodione</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captain 50W or Captain 80WDG</td>
<td>3 to 6 lb (50W) or 1.9 to 3.8 lb (80WDG)</td>
<td>++</td>
<td>1 day</td>
<td>1 day</td>
<td>FRAC-M4</td>
</tr>
<tr>
<td>Quadris Top</td>
<td>12 to 14 fl oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>Same as above. FRAC-3, FRAC-11</td>
</tr>
</tbody>
</table>

### Table 6-13B. New Leaf Growth to Pre-Bloom: Disease Control

<table>
<thead>
<tr>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness (+) or Importance (*)</th>
<th>REI</th>
<th>PHI</th>
<th>Comments (FRAC/IRAC Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Botrytis crown rot</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botrytis crown rot may occur during warm winter periods after early bloom is frost killed and colonized by Botrytis. The pathogen typically grows down the flower stem (peduncl) and colonizes the upper crown tissue, causing death of the leaf petioles, particularly if plants are large or planted densely.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leaf spots, Leaf blights and Powdery Mildew</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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. Powdery mildew and leaf spot may be associated with plant sources; therefore, disease incidence can vary from year to year. Warm wet weather favors disease progress. See previous notes on powdery mildew under “Planting and Early Post-planting: Disease Management” above. In the spring, monitor fields closely, observing the underside of strawberry leaves to determine if powdery mildew is present.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phomopsis leaf blight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captain 50W or Captain 80WDG or</td>
<td>3 to 6 lb (50W) or 1.9 to 3.8 lb (80WDG)</td>
<td>++</td>
<td>24 hr</td>
<td>1 day</td>
<td>FRAC-M4</td>
</tr>
<tr>
<td>Captec 4L or</td>
<td>2.5 qt</td>
<td>++</td>
<td>24 hr</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Topsm-M 70WP* or</td>
<td>1 lb</td>
<td>++</td>
<td>12 hr</td>
<td>1 day</td>
<td>See note above on resistance management. FRAC-1</td>
</tr>
<tr>
<td>Rally 40WSP</td>
<td>2.5 to 5 oz</td>
<td>+++</td>
<td>24 hr</td>
<td>0 days</td>
<td>Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 ounces per acre. FRAC-3</td>
</tr>
<tr>
<td><strong>Common leaf spot, Leaf scorch, Leaf blight (e.g., Mycosphaerella, Phomopsis, Gnomonia)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captain 50W or Captain 80 WDG plus Topsm-M 70WP* or</td>
<td>1 lb (50W) or 1.6 lb (80WDG)</td>
<td>++</td>
<td>24 hr</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Thiram 24%/ Thiram Granulfo or</td>
<td>2.6 qt or 4.4 lb</td>
<td>++</td>
<td>24 hr</td>
<td>1 day</td>
<td>FRAC-M3</td>
</tr>
<tr>
<td>Rally 40WSP</td>
<td>2.5 to 5 oz</td>
<td>+++</td>
<td>24 hr</td>
<td>0 day</td>
<td>Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 ounces per year. FRAC-3</td>
</tr>
<tr>
<td><strong>Powdery mildew (only)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procure 480SC</td>
<td>4 to 8 fl oz</td>
<td>++++</td>
<td>12 hr</td>
<td>1 day</td>
<td>FRAC-3</td>
</tr>
<tr>
<td>Rally 40WSP</td>
<td>2.5 to 5 oz</td>
<td>+++</td>
<td>24 hr</td>
<td>0 day</td>
<td>Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 ounces per year. FRAC-3</td>
</tr>
<tr>
<td>Quintec</td>
<td>4 to 6 fl oz</td>
<td>++++</td>
<td>24 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. Rotate with other mildewicides. Rotation to all non-resisted crops less than 30 days after application is prohibited. FRAC-13</td>
</tr>
<tr>
<td>Tilt and other generics</td>
<td>4 fl oz</td>
<td>+++</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. FRAC-3</td>
</tr>
</tbody>
</table>

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## Table 6-13B. New Leaf Growth to Pre-Bloom: Disease Control

<table>
<thead>
<tr>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness (+) or Importance (*)</th>
<th>REI</th>
<th>PHI</th>
<th>Comments (FRAC/IRAC Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angular (bacterial) leaf spot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic copper sulfate (various formulations) or</td>
<td>2 to 3 lb/100 gal</td>
<td>+</td>
<td>48 hr</td>
<td>0 hr</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. NOTE: All copper sulfate, copper hydroxide and other copper products products labeled for strawberry can be used, but check label for the proper rate because different products will contain different percents of active ingredient. <strong>FRAC–M1. FRAC–M1.</strong></td>
</tr>
<tr>
<td>copper hydroxide (various formulations) or</td>
<td>0.35 to 0.58 a.i. (various formulations)</td>
<td>+</td>
<td>24 hr</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>copper salts of fatty and rosin acids (various formulations) or</td>
<td>3 to 4 pts (various formulations)</td>
<td>+</td>
<td>12 hr</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>cuprous oxide (various formulations)</td>
<td>1.05 – 4.2 lbs a.i. (various formulations)</td>
<td></td>
<td>12 hr</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>Actigard 50 WG</td>
<td>0.5 to 0.75 oz/A</td>
<td>+</td>
<td>0 days</td>
<td></td>
<td>Labeled for suppression; Do not apply to stressed plants. Do not exceed maximum rate. Actigard is a plant activator and has no direct activity on the bacteria. See supplemental label for details. <strong>FRAC–21</strong></td>
</tr>
<tr>
<td>Red stele; Phytophthora crown/root rots</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mefenoxam (Ridomil Gold SL) and other formulations</td>
<td>1 pt</td>
<td>+++</td>
<td>12 hr</td>
<td>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. Use proportionately less fungicide for band treatments (e.g., for drip applications). <strong>FRAC–4</strong></td>
</tr>
<tr>
<td>Ultra Flourish</td>
<td>2 pt</td>
<td></td>
<td>48 hr</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>Metalaxyl (MetaStar and generics)</td>
<td>2 qt/treated acre</td>
<td>+++</td>
<td></td>
<td></td>
<td><strong>FRAC–33</strong></td>
</tr>
<tr>
<td>phosphites (e.g., Aliette, ProPhyt, Phostrol)</td>
<td>Various rates; see label</td>
<td>++</td>
<td>12 hr</td>
<td>0 days</td>
<td>The 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 but sufficient foliage for chemical uptake. <strong>FRAC–33</strong></td>
</tr>
<tr>
<td>Botrytis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove dead and dying leaves just before bloom</td>
<td></td>
<td>**</td>
<td>+++</td>
<td></td>
<td>Pruning leaves may suppress botrytis, especially in systems where fungicides are not used. Leaf removal does not appear economically beneficial where fungicides are used for botrytis management. If anthracnose fruit rot is present, hand-pruning plants creates more disease problems.</td>
</tr>
</tbody>
</table>

### Pre-Harvest — Early Bloom (10%) and into Harvest: Disease Control

**F. J. Louws, Plant Pathology Extension**

The primary diseases of concern at early bloom and into harvest are botrytis fruit rot and anthracnose ripe fruit rot. Most growers do not experience anthracnose problems and may not need an anthracnose management program. Several key principles should be kept in mind:

1. Abound, Azaka, Cabrio, and Pristine belong to the same family of chemicals (QoI; Group 11 chemistry). Pyraclostrobin (Cabrio/Pristine) has offered better control of AFR in recent research efforts. No more than 2 sequential applications of a Group 11 fungicide should be made before alternating with fungicides that have a different mode of action. Pristine also has a second chemical (boscalid) that has good broad spectrum activity against a number of diseases, especially those caused by botrytis. Newly labeled pre-mix products include Quadris Top, which has a broader range of activity (See Efficacy Table below).

2. Captan, Thiram, and Switch offer a broad spectrum of disease control. Switch has not performed well against AFR in North Carolina research.

3. Polyoxin D (PHD: Oso 5%SC; Tavano 5%SC) is as effective as captan for Botrytis and can help reduce the number of captan sprays. Consider substituting Polyoxin D up to 3 times for captan or thiram. Polyoxin D has low activity against AFR.

4. Elevate may not be used in more than 2 consecutive sprays. It is very effective against Botrytis but no other fungal pathogens. Resistance is known in many fields.

5. High risk fungicides of the same chemical class should not be applied in consecutive applications.

6. CaptEvate is a premix of captan and Elevate, which has good broad-spectrum activity.
7. 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 anthracnose ripe fruit rot control.

8. 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.

9. Botrytis has acquired resistance to several fungicides in some grower fields. Tests can be secured through Clemson University to help determine farm-specific recommendations. In the absence of such tests, growers should rely primarily on captan for gray mold control. For instructions on sampling see: http://strawberries.ces.ncsu.edu/wp-content/uploads/2012/02/2014/collection-instructions-11.pdf

Fungicide Schedules: For growers who have received a resistance profile report, follow the recommendations in that report. For growers who adopt a conservative (low risk) fungicide program, apply sprays every 7 to 10 days according to ONE of the following suggested schedules.

**Schedule 1. For cases when there is no risk of anthracnose and growers need to focus on gray mold control (most fields):**
- Rotate two or more of the following: polyoxin D, captan, CaptEvate, Switch, captan + Fontelis.

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 are sufficient to offer season-long control. For instructions on sampling see: http://strawberries.ces.ncsu.edu/wp-content/uploads/2012/02/2014/collection-instructions-11.pdf

**Schedule 2. For cases where anthracnose fruit rot risk is high and gray mold control is also needed:**
- Application 1: At FIRST bloom apply captan or thiram tank mixed with Cabrio.
- Application 2: Apply ONE of these alternatives: CaptEvate OR captan Application 3: Same as Application 1.
- Application 4 and weekly: Rotate two or more of the following: captan, captan + Cabrio.

In other words, there should be continuous coverage with Captan, a FRAC 11 or FRAC 3 product, or the combination. Follow key principle 1 above. During periods of cool wet weather and during bloom, incorporate Switch for better Botrytis control. Pristine or Cabrio show the best efficacy under high anthracnose (AFR) pressure in research studies.

### Table 6-14. Pre-harvest—Early Bloom (10%) and into Harvest: Disease Control

<table>
<thead>
<tr>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness (+) or Importance (*)</th>
<th>REI</th>
<th>PHI</th>
<th>Comments (FRAC/IRAC Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Botrytis gray mold</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captan 50W or 50WDG or</td>
<td>3 to 6 lb or 1.9 to 3.8 lb (50WDG)</td>
<td>+++</td>
<td>24 hr</td>
<td>1 day</td>
<td>See suggested schedule above. Do not apply more than 24 pounds of captan active ingredient per acre per year. FRAC – M4</td>
</tr>
<tr>
<td>Captan 4L or 5W or</td>
<td>2.5 qt</td>
<td>+++</td>
<td>24 hr</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Switch 62.5 WG or 15 WDG or</td>
<td>11 to 14 oz</td>
<td>++++</td>
<td>12 hr</td>
<td>0 days</td>
<td>Begin application at or before bloom and continue on a 7- to 10-day interval. Do not exceed 56 ounces of product per acre per year. Follow label concerning rotational crop waiting periods. See resistance management notes. FRAC-12, FRAC-9</td>
</tr>
<tr>
<td>Ph-D WDG or 5% SC or</td>
<td>6.2 oz</td>
<td>+++</td>
<td>4 hr</td>
<td>0 days</td>
<td>No more than 3 applications per season. Rotate or mix with other FRAC groups. FRAC-19</td>
</tr>
<tr>
<td>Thiram 75 WDG or</td>
<td>6.5 to 13 fl oz</td>
<td>+++</td>
<td>4 hr</td>
<td>0 days</td>
<td>Use high rate when used alone and disease pressure is high. No more than 6 applications per season at maximum rate. Rotate or mix with other FRAC groups. FRAC-19</td>
</tr>
<tr>
<td>Thiram 24/7 or 55 WDG or</td>
<td>4.4 lb or 2.6 qt</td>
<td>+++</td>
<td>24 hr</td>
<td>3 days</td>
<td>Make 3 to 5 applications at 10-day intervals. Thiram is a broad spectrum fungicide similar to captan. FRAC-M3</td>
</tr>
<tr>
<td>Elevate 50WDG or</td>
<td>1.5 lb</td>
<td>++++</td>
<td>4 hr</td>
<td>0 days</td>
<td>Do not apply more than 6 pounds of Elevate per season per acre. Avoid making more than 2 consecutive applications. After the second application, use an alternative botrytis material for 2 consecutive applications before reapplying Elevate. Under light pressure, reduced rates plus Captan may be used (see label). FRAC-17</td>
</tr>
<tr>
<td>Fontelis or Elevate 68 WDG or</td>
<td>16 to 24 fl oz or 3.5 to 5.25 lb</td>
<td>++++</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. Some matted row cultivars may show phytotoxicity (see label). FRAC-7</td>
</tr>
<tr>
<td>Scala or 8 fl oz or 9 fl oz</td>
<td></td>
<td>+++</td>
<td>24</td>
<td>12</td>
<td>Use lower rate only in a tank mix with another fungicide active against gray mold (e.g. Captan or Thiram). FRAC-12</td>
</tr>
<tr>
<td>Fracture or</td>
<td>24.2 to 36.6 fl oz</td>
<td>+</td>
<td>4 hr</td>
<td>1 day</td>
<td>Active ingredient is a protein extract of sweet white Lupin seeds. Some efficacy can be expected at the highest rate.</td>
</tr>
</tbody>
</table>
### Table 6.14. Pre-harvest—Early Bloom (10%) and into Harvest: Disease Control

<table>
<thead>
<tr>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness (+) or Importance (*)</th>
<th>REI</th>
<th>PHI</th>
<th>Comments (FRAC/IRAC Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Botrytis blight and Anthracnose (acutatum)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pristine WG**</td>
<td>18.5 to 23 oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. Do not apply more than 5 applications of Pristine per acre per crop year. FRAC – 11, FRAC – 7</td>
</tr>
<tr>
<td>Merivon</td>
<td>8 to 11 fl oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>No more than 2 sequential applications of Merivon should be made before alternating with fungicides that have a different mode of action. Do not make more than 5 applications per acre per crop year. FRAC – 11, FRAC – 7</td>
</tr>
<tr>
<td>Captain 50W or Captain 80 WDG</td>
<td>3 to 6 lb (50W) or 1.9 to 3.8 lb (80WDG)</td>
<td>+++</td>
<td>1 day</td>
<td>1 day</td>
<td>For better control and resistance management, use Captain applications plus Topsin-M (see label). See suggested schedule above. Do not apply more than 24 lb of Captain active ingredient per acre per year. FRAC – M4</td>
</tr>
<tr>
<td><strong>Anthracnose (acutatum)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abound 2.08 F; Azaka</td>
<td>6.2 to 15.4 fl oz</td>
<td>+++</td>
<td>4 hr</td>
<td>4 hr</td>
<td>See notes above to manage risk of developing fungicide resistance. In recent research, Abound and similar products have performed less well than Cabrio/Pristine. FRAC – 11</td>
</tr>
<tr>
<td>Merivon</td>
<td>5.5 to 8 fl oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>FRAC – 11, FRAC – 17</td>
</tr>
<tr>
<td>Pristine WG</td>
<td>18.5 to 23.0 oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>See notes above to manage risk of developing fungicide resistance. FRAC – 11, FRAC – 7</td>
</tr>
<tr>
<td>Cabrio EG</td>
<td>12.0 to 14.0 oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>See notes above to manage risk of developing fungicide resistance. FRAC – 11</td>
</tr>
<tr>
<td>Tilt and multiple generics</td>
<td>4 fl oz</td>
<td>++</td>
<td>12 hr</td>
<td>0 days</td>
<td>Registered for Anthracnose Fruit Rot only. 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. FRAC – 3</td>
</tr>
<tr>
<td>Quadrax Top</td>
<td>12 to 13 fl oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>Premix of two active ingredients, azoxytrobin (FRAC – 11) and difenoconazole (FRAC – 3). No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action.</td>
</tr>
<tr>
<td>Protocol</td>
<td>1.33 pt</td>
<td>+++</td>
<td>24 hr</td>
<td>1 day</td>
<td>Premix of two active ingredients, thiopeptonate-methyl (FRAC – 1) and propiconazole (FRAC – 3). No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action.</td>
</tr>
<tr>
<td><strong>Anthracnose (‘gloeosporioides’ crown rot)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captain 50W or Captain 80 WDG or</td>
<td>3 to 6 lb (50W) or 1.9 to 3.8 lb (80WDG)</td>
<td>++</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 Topsin-M at 10- to 14-day intervals, for a total of 2 to 3 applications in the fall. FRAC – M4</td>
</tr>
<tr>
<td>Captopr 4L or</td>
<td>2.5 qt</td>
<td>++</td>
<td>24 hr</td>
<td>1 day</td>
<td>FRAC – M4</td>
</tr>
<tr>
<td>Topsin 70WP</td>
<td>1 lb</td>
<td>++</td>
<td>12 hr</td>
<td>1 day</td>
<td>See note on resistance management. FRAC – 1</td>
</tr>
<tr>
<td>Quadrax Top</td>
<td>12 to 14 fl oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>Same as above. FRAC – 3, FRAC – 11</td>
</tr>
<tr>
<td><strong>Powdery mildew (only)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procure 50WS</td>
<td>4.0 to 8.0 oz</td>
<td>+++</td>
<td>12 hr</td>
<td>1 day</td>
<td>Do not plant leafy vegetables within 30 days after application. Do not plant root vegetables within 60 days after application. Rotation to all other crops within 1 year after application, unless Procure is registered for use on those crops, is prohibited FRAC – 3</td>
</tr>
<tr>
<td>Procure 480SC</td>
<td>4.0 to 8.0 fl oz</td>
<td>+++</td>
<td>12 hr</td>
<td>1 day</td>
<td>FRAC – M4</td>
</tr>
<tr>
<td>Rally 40WSP</td>
<td>2.5 to 5.0 oz</td>
<td>+++</td>
<td>24 hr</td>
<td>0 days</td>
<td>Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 oz per year. FRAC – 3</td>
</tr>
<tr>
<td>Quintec</td>
<td>4 to 6 fl oz</td>
<td>+++</td>
<td>24 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. Rotate with other mildewicides. Rotation to all other crops within 1 year after application, unless Quintec is registered for use on those crops, is prohibited. FRAC – 13</td>
</tr>
<tr>
<td><strong>Powdery mildew and Anthracnose (acutatum)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abound 2.08 F; Azaka</td>
<td>6.2 to 15.4 fl oz</td>
<td>+++</td>
<td>4 hr</td>
<td>4 hr</td>
<td>See notes above to manage risk of developing fungicide resistance. FRAC – 11</td>
</tr>
<tr>
<td>Pristine WG</td>
<td>18.5 to 23.0 oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>See notes above to manage risk of developing fungicide resistance. FRAC – 11, FRAC – 7</td>
</tr>
<tr>
<td>Cabrio EG</td>
<td>12.0 to 14.0 oz</td>
<td>+++</td>
<td>12 hr</td>
<td>0 days</td>
<td>See notes above to manage risk of developing fungicide resistance. DO NOT EXCEED 1.5 QT/YEAR. FRAC – 11</td>
</tr>
<tr>
<td>Tilt and other generics</td>
<td>4 fl oz</td>
<td>+++</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. FRAC – 3</td>
</tr>
<tr>
<td><strong>Red stele; Phytophthora rown/root rots</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>metfenoxam (Ridomil Gold SL) (Ultra Flourish)</td>
<td>1.0 pt</td>
<td>+++</td>
<td>12 hr</td>
<td>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. Use proportionately less fungicide for band treatments (e.g., for drip applications). FRAC – 4</td>
</tr>
<tr>
<td>Metalaxyl (MetaStar and generics)</td>
<td>2 qt/treated acre</td>
<td>+++</td>
<td>48 hr</td>
<td>0 days</td>
<td>Apply in sufficient water to move the fungicide into the root zone. Do not exceed 6 quarts per treated acre per year. FRAC – 4</td>
</tr>
<tr>
<td>Phosphates e.g., Aliette ProPhyl, Phostrol</td>
<td>Various rates, see label</td>
<td>++</td>
<td>12 hr</td>
<td>0 days</td>
<td>The phosphate-based chemicals are not as effective as Ridomil Gold. Consider phosphates if the pathogen is known to be resistant to metfenoxam or if strawberry plants have poor root systems but sufficient foliage for chemical uptake. FRAC – 33</td>
</tr>
</tbody>
</table>
### Table 6-14. Pre-harvest—Early Bloom (10%) and into Harvest: Disease Control

<table>
<thead>
<tr>
<th>Management Options</th>
<th>Amount of Formulation per Acre</th>
<th>Effectiveness (+) or Importance (*)</th>
<th>REI</th>
<th>PHI</th>
<th>Comments (FRAC/IRAC Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angular (bacterial) leaf spot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>In most cases angular (bacterial) leaf spot will dry up during warmer weather. However, if cool wet weather persists during bloom and fruit development, the pathogen can colonize the calyx and cause a brown discoloration. These compounds provide some control if started prior to such predicted weather patterns. Repeat applications at 7- to 10-day intervals. Discontinue when phytotoxicity appears, usually after 4 to 5 applications.</td>
</tr>
<tr>
<td>Basic copper sulfate (various formulations)</td>
<td>2 to 3 lb/100 gal</td>
<td>+</td>
<td>48 hr</td>
<td>0 hr</td>
<td></td>
</tr>
<tr>
<td>copper hydroxide (various formulations)</td>
<td>0.35 to 0.58 a.i. (various formulations)</td>
<td>+</td>
<td>24 hr</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>copper salts of fatty and rosin acids (various formulations)</td>
<td>3 – 4 pts (various formulations)</td>
<td>+</td>
<td>12 hr</td>
<td>0 days</td>
<td>NOTE: All copper sulfate, copper hydroxide and other copper products labeled for strawberry can be used, but check label for the proper rate because different products will contain different percentages of active ingredient. All copper materials are FRAC–11.</td>
</tr>
<tr>
<td>cuprous oxide (various formulations)</td>
<td>1.05 – 4.2 lbs a.i. (various formulations)</td>
<td>+</td>
<td>12 hr</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>Actigard 50 WG</td>
<td>0.5 to 0.75 oz/A</td>
<td>+</td>
<td></td>
<td>0 days</td>
<td>Labeled for suppression; Do not apply to stressed plants. Do not exceed maximum rate. Actigard is a plant activator and has no direct activity on the bacteria. See supplemental label for details. FRAC-21</td>
</tr>
<tr>
<td>Pesticide</td>
<td>Anthracnose (crown rot)</td>
<td>Anthracnose (fruit rot)</td>
<td>Gray mold</td>
<td>Powdery mildew</td>
<td>Common leaf spot</td>
</tr>
<tr>
<td>-----------</td>
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<td>-------------------------</td>
<td>-----------</td>
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<td>-----------------</td>
</tr>
<tr>
<td><strong>Strobilurins:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>azoxyostrobin (Abound; Azaka)</td>
<td>++</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>pyraclostrobin (Cabrio)</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>pyraclostrobin + boscalid (Pristine)</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>pyraclostrobin + fluxapyroxad (Merivon)</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Acibenzolar-S-methyl (Actigard)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>azoxyostrobin + difenoconazole (Quadris Top)</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>azoxyostrobin + propiconazole (QuiltXcel)</td>
<td>+++</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>captain (Capitan and generics)</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>copper</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>cyprodinil + fludioxonil (Switch)</td>
<td>++</td>
<td>-</td>
<td>+++</td>
<td>?</td>
<td>+</td>
</tr>
<tr>
<td>fenhexamide (Elevate)</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>?</td>
</tr>
<tr>
<td>fenhexamide + captan (CaptEvate)</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>fosetyl-Al (Aliette)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>iprodione (Rovral and generics)</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>mefenoxam (Ridomil) or similar products</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>metalaxyl (MetaStar) or similar products</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>myclobutanil (Rally)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>penthiopyrad (Fontelis)</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>phosphites (ProPhyt; Phostrol and others)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Polyoxin D (Ph-D; OSO; Tavano)</td>
<td>?</td>
<td>?</td>
<td>++</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>propiconazole (Tilt; other generics)</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>pyrimethanil (Scala)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>quinoxyfen (Quintec)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>sulfur</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>thiophanate-methyl (Topsin M)</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>thiophanate-methyl + propiconazole (Protocol)</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>thiram (Thiram)</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>triflumizole (Procure)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Relative Effectiveness of Various Chemicals for Strawberry Disease Control**

F. J. Louws, Plant Pathology Extension

(— = ineffective; +++ = very effective; ? = efficacy unknown)

Table 6-15. Relative Effectiveness of Various Chemicals for Strawberry Disease Control

---

* = Not effective if pathogen is resistant to the fungicide.
= Phytotoxicity could occur.
X = Chemical use increases problem.
Strawberry Insect Management

H. J. Burrack, Entomology Extension

Examine strawberry plants for insects and mites prior to and following transplant. Consider treating if damaging populations of early season pests (cutworms and spider mites) are present. Initiate a weekly insect sampling program in early spring, prior to flowering. Base insecticide treatments on comparison of field counts to treatment thresholds, when available.

Insecticide Resistance Action Committee (IRAC) mode of action (MOA) groupings are listed following insecticide names. Materials in the same IRAC group have the same mode of action. When selecting insecticides, avoid successive applications of materials in the same IRAC group to minimize potential resistance development. Organically acceptable materials (OMRI listed) are noted under Precautions and Remarks.

Many insecticide active ingredients are available in generic formulations. For brevity, these formulations are not generally listed. Trade names are listed to aid in identifying products and not intended to promote use of these products or to discourage 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 chemical, read and follow all label instructions. Chemical names are subject to change; please check the products.

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### Table 6-16. Strawberry Insect Control

<table>
<thead>
<tr>
<th>Season Pest</th>
<th>Insecticide, Formulation, and IRAC Group</th>
<th>Amount of Formulation per Acre</th>
<th>Reentry Interval (hours)</th>
<th>Pre harvest interval (days)</th>
<th>Precautions and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Transplant</td>
<td>Cyclamen mite</td>
<td>Cyclamen mites are rare in North Carolina strawberries and are typically introduced on infested plants. Inspect plants closely upon receipt and post transplant. fenpyroximate, IRAC 21 (Portal)</td>
<td>2 pt</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10.3 to 14 fl oz</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>imidacloprid, IRAC 4A (Admire Pro)</td>
<td>1 to 2 qt</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fenpropathrin, IRAC 3A (Danitol 2.4 EC)</td>
<td>10.67 to 21.33 fl oz</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>methoxyfenozide, IRAC 18 (Intrepid)</td>
<td>6 to 12 fl oz</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>spinosad, IRAC 5 (Entrust)</td>
<td>1 to 1.25 oz</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>malathion, IRAC 1B (Malathion 57 EC)</td>
<td>1.5 to 3 pt</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bacillus thuringiensis (Bt), IRAC 11B2 (Dipel DF)</td>
<td>0.5 to 1.0 lb</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Slugs and snails</td>
<td>metaldehyde (Deadline Bullets)</td>
<td>0.4 to 1.6 lb</td>
<td>NA</td>
<td>See label</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iron phosphate (Sluggo)</td>
<td>10 to 44 lb</td>
<td>NA</td>
<td>1</td>
</tr>
<tr>
<td>Preharvest</td>
<td>Red imported fire ants</td>
<td>Baits treatments will control entire mounts, but treatments take between twoand four weeks to be fully effective. Treat active mounts off season or before picking begins with directed bait formulations. Ensure that ants are actively foraging before applying baits. If mounts develop during harvest, chenich treatments may reduce activity temporarily. Consult your cooperative extension agent for mount drench recommendations. pyriproxyfen, IRAC 7C (Esteem Ant Bait 0.5% B)</td>
<td>1.5 to 2 lb</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>methoprene, IRAC 7C (Extinction Ant Bait 0.5% B)</td>
<td>1 to 1.5 lb</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Aphids</td>
<td>Aphis are typically infrequent pests in strawberries. If aphids are present preflowing in numbers greater than 10 per newly expanded leaf, they should be managed before bloom. Harvest period populations are often controlled by natural enemies. Aphids typically only warrant preventative treatment, via soil applied insecticides, in nursery production to prevent virus transmission. imidacloprid, IRAC 4A (Admire Pro, soil) (Admire Pro, foliar)</td>
<td>10.5 to 14 fl oz</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>insecticidal soap (M-pede)</td>
<td>2.5 fl oz</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>malathion, IRAC 1B (Malathion 57 EC)</td>
<td>1.5 to 3 pt</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>thiamethoxam, IRAC 4A (Actara)</td>
<td>1.5 to 3 oz</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>
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<tr>
<th>Season Pest</th>
<th>Insecticide, Formulation, and IRAC Group</th>
<th>Amount of Formulation per Acre</th>
<th>Reentry Interval (hours)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Preharvest (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strawberry weevil (clipper)</strong></td>
<td>Preventative treatments for strawberry clipper are not recommended. <em>Materials effective against strawberry clipper are also toxic to bees.</em> Following pollinator protection language on pesticide labels carefully.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bifenthrin, IRAC 3A (Brigade WSB)</td>
<td>6.4 to 32 oz</td>
<td>12</td>
<td>0</td>
<td>Do not apply when bees are foraging. Do not apply more than 80 ounces of product per acre per year.</td>
<td></td>
</tr>
<tr>
<td>carbaryl, IRAC 1A (Sevin 4 XLR)</td>
<td>1 to 2 qt</td>
<td>12</td>
<td>1</td>
<td>Do not apply when bees are foraging, but Sevin XLR is relatively less bee toxic compared to other carbaryl formulations when dry.</td>
<td></td>
</tr>
<tr>
<td>fenpropathrin, IRAC 3A (Danitol 2.4EC)</td>
<td>16 to 21.66 fl oz</td>
<td>24</td>
<td>2</td>
<td>Do not apply when bees are foraging.</td>
<td></td>
</tr>
<tr>
<td><strong>Two-spotted spider mite</strong></td>
<td>Coverage is important for spider mite management. Materials should generally be used at the high label rate, in high volumes of water (200 gallons per acre recommended), and applied using high pressure or air assist equipment. Mites should be treated if they exceed 5 per leaflet prior to harvest.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>abamectin, IRAC 6 (Agri-Mek 0.15 EC)</td>
<td>16 oz</td>
<td>12</td>
<td>3</td>
<td>Make 2 applications 7 to 10 days apart when mites first appear. Do not exceed 64 fluid ounces per acre in a growing season. Do not apply in less than 100 gallons of water per acre. Do not repeat treatment within 21 days of second application. Do not use in strawberry nurseries.</td>
<td></td>
</tr>
<tr>
<td>acequinocyl, IRAC 20B (Kanemite 15 SC)</td>
<td>31 oz</td>
<td>12</td>
<td>1</td>
<td>Allow 21 days between treatments. Do not make more than 2 applications per season.</td>
<td></td>
</tr>
<tr>
<td>bifenthrin, IRAC Unknown (Acamite 50WP)</td>
<td>1 lb</td>
<td>12</td>
<td>1</td>
<td>Use only 2 applications per year. Use in a minimum of 100 gallons per acre.</td>
<td></td>
</tr>
<tr>
<td>etoxazole, IRAC 10B (Zeal)</td>
<td>3 oz</td>
<td>12</td>
<td>1</td>
<td>Zeal is an ovicide/aviticide and should be applied early in the mite life cycle.</td>
<td></td>
</tr>
<tr>
<td>abamectin, IRAC 6 (Agri-Mek 0.15 EC)</td>
<td>16 oz</td>
<td>12</td>
<td>3</td>
<td>One application per season. Will control eggs and suppress small mites. Do not use in nurseries.</td>
<td></td>
</tr>
<tr>
<td>acequinocyl, IRAC 20B (Kanemite 15 SC)</td>
<td>31 oz</td>
<td>12</td>
<td>1</td>
<td>Do not apply more than 48 fluid ounces or make more than three applications per season.</td>
<td></td>
</tr>
<tr>
<td>bifenthrin, IRAC 3A (Brigade WSB)</td>
<td>6.4 to 32 oz</td>
<td>12</td>
<td>0</td>
<td>There are numerous oils registered in strawberries. Oils are effective only if very good coverage is achieved. Oils should not be applied 48 hours or less before freezing temperature, at temperatures over 90 degrees F, or to water-stressed plants. Because oils lack the residual activity of conventional acaricides, they may need to be applied repeatedly for control. Ecotec and Ecotrol are OMRI listed.</td>
<td></td>
</tr>
<tr>
<td>fenpyroximate, IRAC 21 (Portal)</td>
<td>2 pt</td>
<td>12</td>
<td>1</td>
<td>Do not apply more than 48 fluid ounces or make more than three applications per season.</td>
<td></td>
</tr>
<tr>
<td>hexythiazox, IRAC 10A (Savvy 50 WP)</td>
<td>7 oz</td>
<td>12</td>
<td>3</td>
<td>Do not apply more than 64 fluid ounces per acre. Do not apply more than 80 ounces of product per acre per year.</td>
<td></td>
</tr>
<tr>
<td>spiroimesifen, IRAC 23 (Oberon 2SC)</td>
<td>16 fl oz</td>
<td>12</td>
<td>3</td>
<td>Do not apply more than 48 fluid ounces per acre. Do not apply more than 80 ounces of product per acre per year.</td>
<td></td>
</tr>
<tr>
<td><strong>Harvest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sap beetle</strong></td>
<td><em>Materials effective against sap beetles are toxic to bees.</em> Follow pollinator protection language on labels carefully.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bait buckets and fruit removal</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Cultural control is the most effective form of sap beetle management. Sap beetles are attracted to the odor of overripe fruit. Thorough picking will reduce sap beetle populations and can eliminate the need for treatment. Culls should be disposed of offsite or buried. Bucket traps baited with rotting fruit or bread dough placed outside the field will attract sap beetles and can be used to determine when populations are present or to lure insects from field. Buckets should be checked and emptied at least weekly. Baits should be disposed of offsite or buried.</td>
<td></td>
</tr>
<tr>
<td><strong>Spotted wing drosophila</strong></td>
<td>Female spotted wing drosophila (SWD) lay eggs in ripening and ripe soft skinned fruits. SWD injury in spring bearing strawberries has been inconsistent in previous years, but summer and fall fruiting strawberries are at high risk of infestation. If SWD are active during strawberry harvest, treatments should be applied weekly and reapplied in the event of rain. <em>Many materials effective against SWD are toxic to bees.</em> Follow pollinator protection language on labels carefully. Apply SWD treatments in the evening or night, when bees are not actively foraging.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bifenthrin, IRAC 3A (Brigade WSB)</td>
<td>6.4 to 32 oz</td>
<td>12</td>
<td>0</td>
<td>There are many bifenthrin formulations. Do not apply when bees are foraging. Do not apply more than 80 ounces of product per acre per year. Brigade is effective against adult sap beetles.</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spotted wing drosophila (continued)</td>
<td>fenpropathrin, IRAC 3A (Danitol 2.4 EC)</td>
<td>16 to 21.33 fl oz</td>
<td>24</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>malathion, IRAC 1B (Malathion 57 EC)</td>
<td>1.5 to 3 pt</td>
<td>12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spinosad, IRAC 5 (Entrust)</td>
<td>1.25 to 2.5 fl oz</td>
<td>4</td>
<td>1</td>
<td>Entrust is OMRI listed.</td>
</tr>
<tr>
<td></td>
<td>spinetoram, IRAC 5 (Radiant SC)</td>
<td>6 to 10 fl oz</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Corn earworm, European corn borer</td>
<td>corn earworm and European corn borer larvae can feed on strawberry fruit. This damage is most common in warm years. Watch for eggs on strawberry fruit near the stem end. Adult moths can be monitored using pheromone traps conditions are appropriate for infestation. Many materials effective against caterpillar pests are toxic to bees. Follow pollinator protection language on labels carefully.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>chlorantraniliprole IRAC 28 (Coragen)</td>
<td>3.5 to 5 fl oz</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>novaluron IRAC 15 (Rimon 0.83 EC)</td>
<td>9 to 12 fl oz</td>
<td>12</td>
<td>1</td>
<td>Rimon treatments must be timed to egg hatch.</td>
</tr>
<tr>
<td></td>
<td>Bacillus thuringiensis (Bt), IRAC 11B2 (Dipel DF)</td>
<td>0.5 to 1.0 lb</td>
<td>4</td>
<td>0</td>
<td>Dipel DF is OMRI listed.</td>
</tr>
<tr>
<td>Tarnished plant bugs or Lygus bugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lygus bugs are typically only present in North Carolina strawberries at the end of the spring season, although they may be more problematic in day neutral, ever-bearing, or other strawberry season extension systems. Lygus bug injury results in malformed fruit and can resemble poor pollination. Lygus injury can be distinguished from poor pollination based on seed size. The seeds of Lygus damaged fruit are all the same size, while poor pollination results in varied seed sizes. Many materials effective against lygus bugs are toxic to bees. Follow pollinator protection language on labels carefully.</td>
<td>novaluron IRAC 15 (Rimon 0.83 EC)</td>
<td>9 to 12 fl oz</td>
<td>12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>bifenthrin, IRAC 3A (Brigade WSB)</td>
<td>6.4 to 32 oz</td>
<td>12</td>
<td>0</td>
<td>There are many bifenthrin formulations. Do not apply when bees are foraging. Do not apply more than 80 ounces of product per acre per year. Brigade is effective against adult sap beetles.</td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC 3A (Danitol 2.4 EC)</td>
<td>16 to 21.33 fl oz</td>
<td>24</td>
<td>2</td>
<td>Do not apply when bees are foraging.</td>
</tr>
<tr>
<td>Flower thrips</td>
<td>Treatment is only necessary when thrips injury is present on berries. Thrips injury, which resembles bronzing on the stem end of berries, will typically not be present until the end of the season, if at all. Materials effective against thrips are toxic to bees. Follow pollinator protection language on labels carefully.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>spinosad, IRAC 5 (Entrust)</td>
<td>1.25 to 2.5 fl oz</td>
<td>4</td>
<td>1</td>
<td>Entrust is OMRI listed.</td>
</tr>
<tr>
<td></td>
<td>spinetoram, IRAC 5 (Radiant SC)</td>
<td>6 to 10 fl oz</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Spittlebug</td>
<td>Spittlebugs are occasional pests in strawberries and should only be treated if directly damaging fruit.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>fenpropathrin, IRAC (Danitol 2.4 EC)</td>
<td>10.67 oz</td>
<td>24</td>
<td>2</td>
<td>Do not apply when bees are foraging. Do not make more than two applications.</td>
</tr>
<tr>
<td></td>
<td>malathion (several products) 57 EC</td>
<td>1.5 pt</td>
<td>12</td>
<td>3</td>
<td>Do not apply when bees are foraging.</td>
</tr>
</tbody>
</table>

Further Information