Abbreviations and Symbols Used in This Publication

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>acre, aerosol</td>
</tr>
<tr>
<td>ACS</td>
<td>microencapsulated in aqueous suspension</td>
</tr>
<tr>
<td>AI</td>
<td>active ingredient</td>
</tr>
<tr>
<td>CS</td>
<td>concentrate suspension</td>
</tr>
<tr>
<td>D</td>
<td>dust</td>
</tr>
<tr>
<td>DF</td>
<td>dry flowable</td>
</tr>
<tr>
<td>DG</td>
<td>dispersible granule</td>
</tr>
<tr>
<td>E</td>
<td>emulsion, emulsifiable</td>
</tr>
</tbody>
</table>

* Restricted-use pesticide; may be purchased and used only by certified applicators
† Not for use in Nassau and Suffolk Counties
∆ Rate or other application restrictions apply. See label for more information.

Every effort has been made to provide correct, complete, and up-to-date pest management information for New York State at the time this publication was released for printing (April 2022). Changes in pesticide registrations, regulations, and guidelines occurring after publication are available in county Cornell Cooperative Extension offices or from the Cornell Cooperative Extension Pesticide Safety Education Program (CCE-PSEP) (psep.cce.cornell.edu).

Trade names used in this publication are for convenience only. No endorsement of products is intended, nor is criticism of unnamed products implied.

These guidelines are not a substitute for pesticide labeling. Always read and understand the product label before using any pesticide.

The guidelines in this bulletin reflect the current (and past) authors’ best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this bulletin does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

Cover photo by: Andy Senesac, Cornell Cooperative Extension – Suffolk County.
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1 Pesticide Information

1.1 Pesticide Classification and Certification

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) created two classifications of pesticides – general-use and restricted-use. General-use pesticides may be purchased and used by anyone. Restricted-use pesticides can only be purchased by a certified applicator. Restricted-use pesticides must also be used by a certified applicator or someone under their supervision.

The same federal law that classifies pesticides divides applicators into two groups: private and commercial. Private applicators use or supervise the use of pesticides to produce agricultural commodities or forest crops on land owned or rented by the private applicator or their employer. A farmer must be certified as a private applicator in order to purchase and use restricted-use pesticides on agricultural commodities. (No certification is needed if a farmer does not use restricted-use pesticides.)

A commercial applicator uses or supervises the use of pesticides for any purpose or on any property not covered by the private applicator classification. In New York, a commercial applicator must be certified to purchase or use any pesticide whether it is general- or restricted-use.

Information about pesticide certification and classification is available from your Cornell Cooperative Extension office (cce.cornell.edu/localoffices), regional NYSDEC pesticide specialist (www.dec.ny.gov/about/558.html), the Pesticide Applicator Training Manuals (https://www.cornellstore.com/books/cornell-cooperative-ext-pmep-manuals), or the Cornell Cooperative Extension Pesticide Safety Education Program (psep.cce.cornell.edu).

1.2 Use Pesticides Safely

Using pesticides imparts a great responsibility on the user to protect their health and that of others and to protect the environment. Keep in mind there is more to “pesticide use” than the application. Pesticide use includes mixing, loading, transporting, storing, or handling pesticides after the manufacturer’s seal is broken; cleaning pesticide application equipment; and preparing a container for disposal. These activities require thoughtful planning and preparation. They are also regulated by state and federal laws and regulations intended to protect the user, the community, and the environment from any adverse effects pesticides may cause.

1.2.1 Plan Ahead

Many safety precautions should be taken before you actually begin using pesticides. Too many pesticide applicators are dangerously and needlessly exposed to pesticides while they are preparing to apply them. Most pesticide accidents can be prevented with informed and careful practices. Always read the label on the pesticide container before using the pesticide. Make sure you understand and can follow all directions and precautions on the label. Be prepared to handle an emergency exposure or spill. Know the first aid procedures for the pesticides you use.

1.2.2 Move Pesticides Safely

Carelessness in transporting pesticides can result in broken containers, spills, and contamination of people and the environment. Once pesticides are in your possession, you are responsible for safely transporting them. Accidents can occur even when transporting materials a short distance. You are responsible for a pesticide accident so take every effort to transport pesticides safely. Be prepared for an emergency.

1.2.3 Personal Protective Equipment and Engineering Controls

Personal protective equipment needs depend on the pesticide being handled. Required personal protective equipment (PPE) are listed on pesticide labels. The required PPE are is based on the pesticide’s toxicity, route(s) of exposure, and formulation. Label required PPE are the minimum that must be worn during the pesticide’s use. Pesticide users can always wear more protection than required.

The type of protective equipment used depends on the type and duration of the activity, where pesticides are being used, and exposure of the handler. Mixing/loading procedures often require extra precautions. Studies show you are at a greater risk of accidental poisoning when handling pesticide concentrates. Pouring pesticide concentrates from one container to another is the most hazardous activity.

Engineering controls are devices that help prevent accidents and reduce a pesticide user’s exposure. One example is a closed mixing/loading system that reduces the risk of exposure when dispensing concentrated pesticides. Consult the product label for more information on using engineering controls in place of PPE.

1.2.4 Avoid Drift, Runoff, and Spills

Pesticides that move out of the target area can injure people, damage crops, and harm the environment. Choose weather conditions, pesticides, application equipment, pressure, droplet size, formulations, and adjuvants that minimize drift and runoff hazards. See product labels for specific application and equipment requirements.
2 Insect and Mite Pest Management of Trees and Shrubs

2.1 Introduction
More species and cultivars of ornamental plants are grown in nurseries and in the landscape than all other kinds of cultivated crops combined. While this is a statement of pride among ornamental horticulturists, it is likewise true that an even greater number of pest species find these plants and use them as food, causing an expenditure of time and dollars in added maintenance costs.

Concise pesticide guidelines are given in this publication for managing more than 150 species of insects and mites on over 50 kinds of ornamental trees and shrubs which grow in the four plant zones of New York. Practical and effective control of insects and mites that attack ornamental trees and shrubs can be achieved by recognizing the pests, understanding their life histories, and using a skillfully planned integrated pest management (IPM) program.

IPM goes beyond the use of chemical pesticides and includes every means of pest control that may be applied under a given set of circumstances. Useful pest control techniques must be compatible, so IPM programs may vary from nursery to nursery or landscape to landscape and may require professional assistance to organize and maintain. What follows are but fragments of the IPM concept.

2.2 How to Use the Insect and Mite Chapter
This chapter is divided into the following sections:
• 2.5 Text on Biorational Pest Management Tools and Tactics
• 2.6 Text on Chemical Insecticides
  – mode of action
  – phytotoxicity
  – timing of application
  – formulation
  – systemic insecticides
  – best management practices for soil application
  – oil sprays
  – shelf life
  – pesticide adjuvants
  – mist blowers
• 2.7 Registered Insecticides and Acaricides Table – arranged by active ingredient
• 2.8 Insects and Mites Destructive to Woody Oramentals – arranged by host plant
• 2.9 Pest Management Timing - arranged by month/season with growing degree day (GDD) and plant phenology information (PPI)
• 2.10 Insect and Mite Pest Management – arranged by pest with IPM information, management options, and application timing

2.3 About the Tables
Sections 2.6 and 2.8 contain lists and tables that permit quick access to a mass of pest management information. Be certain that you understand the footnotes and how to use these tables. To assist in diagnosis (identification) of a pest, first look at Table 2.8.1. Find the plant of concern, then note the common or "key" pests associated with the plant. Numbers following the names of pests correspond to pages with descriptions in Insects That Feed on Trees and Shrubs, second edition, published by Cornell University Press. Plate numbers showing illustrations are indicated in boldface type. Book is available from Cornell University Press, 800-848-6224 (U.S. & Canada) or at https://www.cornellpress.cornell.edu.

Next, turn to Table 2.10.1, remembering the name of the suspect pest. Entries for each pest include signs and/or symptoms of infestation, management options, timing of treatment, and IPM considerations. If you are interested in the characteristics of a particular pesticide-what it will control, formulations available, EPA numbers, nursery versus landscape uses, restricted-entry intervals, phytotoxicity, and other precautions-see Table 2.7.1.

The proper biological timing of control measures for each pest in each locality can be achieved through experience, by using the growing degree-day system, or by phenological indicator plants (see Table 2.9.1). Keep a record of treatments and schedules used from year to year to accumulate seasonal experience for spraying. Records of normal growth phenomena such as bud development and flowering are useful in documenting the proper time for treatment in your geographical area.

2.4 Insect and Mite Control for Propagation Ranges, Greenhouses, and Perennials
Control of insect and mite problems for interior use in greenhouses, arboreta, and interiorscapes as well as herbaceous perennials are covered in the Cornell Guide for the Integrated Management of Greenhouse Crops and Herbaceous Perennials. This publication is available in print and online formats through the Cornell Store at Cornell University (844-688-7620 or online at: https://store.cornell.edu/books/cornell-cooperative-ext-pme-p-guidelines).

2.5 Biorational Pest Management Tools and Tactics

2.5.1 "Biorational" Controls
Biorational tactics begin with cultural and mechanical practices such as diverse cropping, crop rotation, and
2.8 Pest Management Timing

This table gives the times that pests can be most effectively controlled in New York State. Calendar timing is a broad approximation and applies only to southeastern New York during an average/normal season. Timing will vary for other areas and seasonally from year to year. Use the three timing systems by checking one against the other. Timing systems are not a substitute for scouting. For more information on these systems of timing applications see section 2.6.3.

Table 2.8.1. Pest management timing by calendar, growing degree-day (GDD), and plant phenology indicator (PPI)

<table>
<thead>
<tr>
<th>Host</th>
<th>Pest</th>
<th>Stage</th>
<th>GDD (Base 50°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dormant Season (usually March or early April): No plant phenological markers offered for dormant season.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arborvitae</td>
<td>Fletcher scale</td>
<td>immature</td>
<td>20–60</td>
</tr>
<tr>
<td></td>
<td>spruce spider mite</td>
<td>egg</td>
<td>7–121</td>
</tr>
<tr>
<td>Azalea</td>
<td>azalea bark scale</td>
<td>adult</td>
<td>Not Available</td>
</tr>
<tr>
<td>Bittersweet</td>
<td>euonymus scale</td>
<td>adult</td>
<td>35–70</td>
</tr>
<tr>
<td>Crabapple</td>
<td>European red mite</td>
<td>egg</td>
<td>7–58</td>
</tr>
<tr>
<td>Deciduous plants</td>
<td>aphids</td>
<td>egg</td>
<td>7–100</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>Cooley spruce gall adelgid</td>
<td>immature</td>
<td>22–91</td>
</tr>
<tr>
<td>Elm</td>
<td>elm bark beetle</td>
<td>larva</td>
<td>7–120</td>
</tr>
<tr>
<td></td>
<td>European elm scale</td>
<td>nymph</td>
<td>7–120</td>
</tr>
<tr>
<td></td>
<td>European red mite</td>
<td>egg</td>
<td>7–58</td>
</tr>
<tr>
<td></td>
<td>lecanium scales</td>
<td>adult</td>
<td>35–110</td>
</tr>
<tr>
<td>Euonymus</td>
<td>euonymus scale</td>
<td>adult</td>
<td>35–70</td>
</tr>
<tr>
<td>Flowering fruit trees</td>
<td>lecanium scales</td>
<td>adult</td>
<td>35–110</td>
</tr>
<tr>
<td>Hemlock</td>
<td>elongate hemlock scale</td>
<td>adult</td>
<td>7–120</td>
</tr>
<tr>
<td></td>
<td>hemlock rust mite</td>
<td>immature/adult</td>
<td>7–450</td>
</tr>
<tr>
<td></td>
<td>hemlock scale</td>
<td>adult</td>
<td>35–121</td>
</tr>
<tr>
<td></td>
<td>spruce spider mite</td>
<td>egg</td>
<td>7–121</td>
</tr>
<tr>
<td>Holly</td>
<td>southern red mite</td>
<td>egg</td>
<td>7–91</td>
</tr>
<tr>
<td>Honeylocust</td>
<td>lecanium scales</td>
<td>adult</td>
<td>35–110</td>
</tr>
<tr>
<td>Juniper</td>
<td>juniper scale</td>
<td>adult/egg</td>
<td>22–148</td>
</tr>
<tr>
<td></td>
<td>spruce spider mite</td>
<td>egg</td>
<td>7–121</td>
</tr>
<tr>
<td>Lilac</td>
<td>oystershell scale</td>
<td>egg</td>
<td>7–91</td>
</tr>
<tr>
<td>Magnolia</td>
<td>magnolia scale</td>
<td>nymph</td>
<td>22–91</td>
</tr>
<tr>
<td>Maple</td>
<td>lecanium scales</td>
<td>adult</td>
<td>35–110</td>
</tr>
<tr>
<td></td>
<td>maple gall mites</td>
<td>adult</td>
<td>50–148</td>
</tr>
<tr>
<td>Mountain ash</td>
<td>European red mite</td>
<td>egg</td>
<td>7–58</td>
</tr>
<tr>
<td>Oak</td>
<td>golden oak scale</td>
<td>adult</td>
<td>7–121</td>
</tr>
<tr>
<td></td>
<td>kermes oak scale</td>
<td>adult</td>
<td>7–91</td>
</tr>
<tr>
<td></td>
<td>lecanium scales</td>
<td>adult</td>
<td>35–110</td>
</tr>
<tr>
<td>Pachysandra</td>
<td>euonymus scale</td>
<td>adult</td>
<td>35–70</td>
</tr>
<tr>
<td>Pine</td>
<td>pine bark adelgid</td>
<td>immature</td>
<td>22–58</td>
</tr>
<tr>
<td></td>
<td>pine needle scale</td>
<td>eggs,females</td>
<td>22–58</td>
</tr>
<tr>
<td></td>
<td>spruce spider mite</td>
<td>egg</td>
<td>7–121</td>
</tr>
<tr>
<td>Spruce</td>
<td>eastern spruce gall adelgid</td>
<td>immature</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td>spruce bud scale</td>
<td>immature</td>
<td>22–121</td>
</tr>
<tr>
<td></td>
<td>spruce spider mite</td>
<td>egg</td>
<td>7–121</td>
</tr>
<tr>
<td>Table 2.9.1 Insect and mite management¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOTE:</strong> See Table 2.10.1 for pesticide trade names containing the active ingredients noted below. Where a specific product is listed after a recommended pesticide, only that product is labeled for that use. Always confirm that the site you plan to treat and the pest you wish to control are listed on the label before using any pesticide.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Symbols Used:</strong> * = Restricted-use pesticide; *F = indicates a federally restricted-use pesticide. † = Not for use in Nassau and Suffolk Counties.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Dogwood borer (123), Synanthedon scitula (moth, clearwing borer) (continued)**

| When to treat: | Mid-May to mid-June, 148–700 GDD (borers in bark), PPI-Cercis, Philadelphus. On crabapple, spray mid-July to early August. Pheromone lure traps useful to determine spray timing: treat 10 days after first moth is trapped and again after six weeks if moths continue to be trapped. |
| IPM considerations: | Other hosts include Betula, Malus, Myrica, Sorbus, Quercus, Castanea, blueberry and others. Keep trees growing vigorously. Include trunk and lower branches with bark spray. Pesticides control adults. Paint fresh bark wounds with white latex paint. Kousa dogwood appears to be resistant. |

**Dogwood sawfly (55), Macremphytus tarsatus**

| Plant abnormalities: | Skeletonized leaves at first, followed by loss of all of leaf except midvein. |
| Management options: | No consistently effective parasites or predators. Acephate, carbaryl, chlorantraniliprole, cyclaniliprole, cyfluthrin, diflubenzuron, gamma-cyhalothrin, emamectin benzoate, imidaclopid, spinosad. **2(ee) recommendation of Acelepryn for use on unlabeled pest dogwood sawfly. The 2(ee) recommendation must be in the applicator’s possession at the time of use. See 2(ee) at https://www.dec.ny.gov/nyspad/products. |
| When to treat: | Spray anytime in July, 1151–1500 GDD, PPI-Ceanothus americanus, Abelia. |
| IPM considerations: | Often feed in groups; remove by hand where practical. |

**Douglas-fir needle midge (15), Contarinia pseudotsugae**

| Plant abnormalities: | Needles may have slight swelling with yellow or purplish discoloration, tips may turn brown. |
| Management options: | Bifenthrin (*OnyxPro, *Baseline); *Christmas trees only: acephate, thiamethoxam (25WG). |
| When to treat: | Time applications within a week after first adults are detected in traps. Traps are set prior to budbreak in spring. In central Pennsylvania, adults were found active around 200–400 GDD. |
| IPM considerations: | See online at ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/19004/ec1373-e.pdf for more information on pest biology and trap construction. |

**Eastern spruce gall adelgid (50), Adelges abietis**

| Plant abnormalities: | Gall at the base of new shoots, especially on Norway & Serbian spruce. |
| Management options: | No effective parasites or predators. Acetamiprid, carbaryl, cyantraniliprole (drench), cyclaniliprole, horticultural oil, imidaclopid (soil or foliar application), insecticidal soap, spirotetramat, thiamethoxam (25WG, Christmas trees only). |
| When to treat: | Sprays mid-April to early May, 22–170 GDD, PPI-boxelder, periwinkle, or fall after egg hatch. Soil application late fall or early spring. |
| IPM considerations: | Pesticides work best in the spring. Late-summer treatment must be timed to the emergence of adult adelgids from the summer galls. Prune out and destroy green galls. Colorado blue, Engelmann, black, white and red spruces sometimes affected. |

**Eastern tent caterpillar (76), Malacosoma americanum (moth)**

| Plant abnormalities: | Chewed leaves, branch defoliation; webs usually formed in branch crotches. |
| Management options: | Parasites usually effective, but there are occasional outbreaks or spot infestations. Acephate (for flowering crabapples only), azadirachtin, Bacillus thuringiensis subsp. kurstaki and aizawai, dicrotophos (for flowering crabapples only), bifenthrin, carbaryl, chlorantraniliprole (1.67SC, spray), cryolite, cyantraniliprole, cyclaniliprole, cyfluthrin, diazinon, diflubenzuron, emamectin benzoate, fluvalinate, gamma-cyhalothrin, indoxacarb, insecticidal soap, lambda-cyhalothrin, malathion, permethrin, phosmet, spinosad. |
| When to treat: | Late April through first two weeks of May, 90–190 GDD, PPI-Japanese quince. |
| IPM considerations: | Survey ornamental host trees after leaves drop to find egg masses. Prune off or remove egg masses by early spring. Eggs hatch when wild cherry leaves begin to unfold; remove and destroy tents containing caterpillars during the day. Favored hosts include apple, crabapple, and cherry. |
Table 2.10.1. Insecticides and acaricides registered for ornamental trees and shrubs

<table>
<thead>
<tr>
<th>Active Ingredient (Mode of Action Group)</th>
<th>Trade Name(s), Formulation, and Company</th>
<th>EPA Reg. No.</th>
<th>Organic Listed</th>
<th>Use†</th>
<th>REI§ (hrs.)</th>
<th>PPE Applicator</th>
<th>Early Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifenthrin (3A) (continued)</td>
<td></td>
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</tr>
<tr>
<td>root dip treatment for preventive root weevil control. †OnyxPro is also approved as a dip treatment (14.4 fl oz rate) for containerized or balled-and-burlapped nursery stock under the National Plant Board US Domestic Japanese Beetle Harmonization Plan (nationalplantboard.org/wp-content/uploads/docs/jbcolumn.pdf)†For Christmas trees only. 7Not for use on sod farms, golf course turf, or nurseries; can be used in greenhouses and in landscapes. 8(ce) label allows use for spotted lanternfly.</td>
<td></td>
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<tr>
<td>Bifenthrin (3) + imidacloprid (4A)</td>
<td></td>
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</tr>
<tr>
<td>*Bithor SC (0.36 + 0.45SC, Ensyxst IV)†</td>
<td>83923-2</td>
<td>–</td>
<td>L</td>
<td>NA</td>
<td>ac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For turfgrasses and for spray and soil application to trees, shrubs, flowers and groundcovers. In NY State, do not apply to grass or turf within 100' of a body of water. No soil injection in Nassau and Suffolk Counties. Note other label restrictions. Imidacloprid demonstrates the properties and characteristics associated with chemicals detected in groundwater. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. See Section 2.6.6 for more information on imidacloprid use. Toxic to fish and aquatic invertebrates.</td>
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<tr>
<td>Buprofezin (16)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>*†Talus 70DF (SePro)</td>
<td>71711-21-67690</td>
<td>–</td>
<td>N, L</td>
<td>12</td>
<td>abc</td>
<td>bck</td>
<td></td>
</tr>
<tr>
<td>Insect growth regulator for control of whiteflies, mealybugs, plant- and leafhoppers, and scales for use in greenhouses, nurseries, Christmas trees, landscapes and other sites. See label for specific species controlled. Has contact, ingestion, and vapor activity. Good coverage is essential. Only 2 applications allowed per year. Not for use, sale, or distribution in Nassau and Suffolk Counties.</td>
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<tr>
<td>Burkholderia spp. strain A396</td>
<td></td>
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</tr>
<tr>
<td>Venerate XC Bioinsecticide (Marrone)</td>
<td>84059-14</td>
<td>OMRI</td>
<td>N</td>
<td>4</td>
<td>abchl</td>
<td>cfhk</td>
<td></td>
</tr>
<tr>
<td>Biopesticide composed of heat-killed cells and spent fermentation media labeled for control of certain lepidopterous caterpillars on ornamentals. In NY, application by air or within 100 feet of any surface water is prohibited. Do not allow drift to blooming crops or weeds if bees are foraging. Store cool and dry, do not freeze.</td>
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<tr>
<td>Carbaryl (1A)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Carbaryl 4L (Drexel)</td>
<td>19713-49</td>
<td>–</td>
<td>N, L</td>
<td>12</td>
<td>acfi</td>
<td>dfgj</td>
<td></td>
</tr>
<tr>
<td>Carbaryl 4L (Loveland)</td>
<td>34704-447</td>
<td>–</td>
<td>N, L</td>
<td>12</td>
<td>acfi</td>
<td>dfgj</td>
<td></td>
</tr>
<tr>
<td>Sevin SL (4SL, Bayer)†</td>
<td>432-1227</td>
<td>–</td>
<td>N, L</td>
<td>12</td>
<td>acfi</td>
<td>dfgj</td>
<td></td>
</tr>
<tr>
<td>Sevin Brand SL (4SL, Lesco)</td>
<td>432-1227-10404</td>
<td>–</td>
<td>N, L</td>
<td>12</td>
<td>cefgij</td>
<td>dfgj</td>
<td></td>
</tr>
<tr>
<td>Sevin XLR Plus (4F, Tessenderlo)†</td>
<td>61842-37</td>
<td>–</td>
<td>N</td>
<td>12</td>
<td>efgij</td>
<td>dfgj</td>
<td></td>
</tr>
<tr>
<td>Spray residues of some formulations may stain masonry, wood, or painted surfaces. Contact and stomach activity on insects. Toxic to certain predator mite species. May contribute to buildup of mite populations. Do not use on Boston Ivy or Virginia creeper (Parthenocissus). Avoid use in hot, humid weather; injury may occur on tender foliage, particularly if plants are wet when treated. Long residual effectiveness. Especially effective against adult Japanese beetles, rose chafer, and numerous caterpillars, including sawflies. Avoid applying to plants in bloom; highly toxic to honey bees. Highly toxic to aquatic invertebrates. Store in a cool, dry place below 100°F. Buffer spray water to pH ≤7. Do not mix with alkaline materials.</td>
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<tr>
<td>Chlorantraniliprole (28)</td>
<td></td>
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</tr>
<tr>
<td>*†Acelerpy Insecticide (1.67SC, Syngenta)†</td>
<td>100-1489</td>
<td>–</td>
<td>L, N</td>
<td>4</td>
<td>ac</td>
<td>ac</td>
<td></td>
</tr>
<tr>
<td>*†Acelerpy 0.067% Insecticide plus Fertilizer (Lesco)</td>
<td>352-734-10404</td>
<td>–</td>
<td>L</td>
<td>–</td>
<td>ac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*†Shaw’s Turf Fertilizer with 0.067% Acelerpy (Knox Fertilizer)</td>
<td>8378-70</td>
<td>–</td>
<td>L</td>
<td>–</td>
<td>ac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced-risk insecticide labeled for soil application to control white grubs in ornamental landscape plantings. 1.67SC formulation also includes uses in nurseries, greenhouses, and landscapes as soil or container application to control white grubs, lace bugs and aphids; soil application for birch leaffminer; foliar spray for leaf-feeding caterpillars; and bark spray for clearing borers. Not for sale, distribution, and/or use in Nassau, Suffolk, Kings, Queens Counties. Toxic to aquatic invertebrates, oysters, and shrimp. Note buffer zone requirements and groundwater advisory on product labels.</td>
<td></td>
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<tr>
<td>Chromobacterium subsugae strain PRAA4-1</td>
<td></td>
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</tr>
<tr>
<td>Grandevo WDG (30%, Marrone)</td>
<td>84059-27</td>
<td>OMRI</td>
<td>N, L</td>
<td>4</td>
<td>abchl</td>
<td>bchb</td>
<td></td>
</tr>
<tr>
<td>Reduced-risk insecticide for fall webworm and spongy moth (formerly gypsy moth).</td>
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</tr>
</tbody>
</table>
3 Disease Management for Trees and Shrubs

3.1 General Measures for Disease Prevention

Because trees and shrubs live for many years, their susceptibility to disease is influenced not only by current climatic and environmental conditions but also by conditions and care during previous years. Maltreatment and lack of care favor many diseases. Many issues in nurseries and plantings can be minimized by selection of proper planting sites, avoidance of unnecessary wounding, routine care including fertilization and timely watering and pruning, and preventive measures such as those described below.

Trees and shrubs on sites subject to deep soil freezing should be mulched to prevent root injury. Evergreens susceptible to unusual winter drying, such as those planted in exposed areas, should be treated with an antidesiccant.

Disinfect your tools regularly when pruning to control diseases. An easy, effective way to do this is to swab the cutting blades with an aqueous solution of denatured alcohol prepared by mixing 7 parts alcohol with 3 parts water. A vial or other pocket-sized container will hold a saturated cotton swab.

Discoloration and decay following pruning are minimized if exposed tissues are allowed to close of their own accord. Applications of shellac or another wound dressing can be used where wound invasion by canker-causing fungi or bacteria is likely to occur.

For new plantings, choose pest-resistant plants where available (https://nysipm.cornell.edu/agriculture/ornamental-crops/disease-and-insect-resistant-ornamental-plants/). Named cultivars propagated in nurseries and offered for landscape use in the last 15 years have usually been monitored for insect and disease susceptibility in the nursery, and many highly susceptible individuals have been eliminated from production. Table 3.4.1 also lists some disease-resistant selections.

3.2 Nursery Hygiene

Do not let sloppy nursery hygiene ruin your investment in clean plants and soil fumigation. Soilborne pathogenic fungi, bacteria, and nematodes are carried into the nursery and spread within it by dirty feet, implements, and machines; moving surface water; blowing soil; and infested or infected plants.

1. Insist on clean stock. Do not order or accept stock likely to be infested with nematodes, crown gall bacteria, the Verticillium wilt pathogen, or similar organisms.
2. Stabilize all open soil and maintain windbreaks. Cover dirt roads with gravel or oil.

3. Require equipment moving between nursery blocks to pass through a central area where soil is washed off. The equipment can be parked on a bed of cobbles, and the soil particles will be carried down through the cobbles. A steel grating over a pit is a better arrangement for a permanent wash-down area. If not possible to clean equipment between blocks, make sure to work in any infected or infested blocks last, and clean equipment at the end of the day.
4. Clean boots and hand tools as you do other equipment.
5. When roguing diseased plants or pruning diseased parts of plants, bag and dispose of, destroy or bury the discards.
6. Do not allow surface water to run from one nursery block to another. Divert it into ditches or culverts.
7. Remember that irrigation water can carry pests and pathogens. Select a clean source and keep it clean.
8. Allow no direct traffic from outdoor areas to indoor propagation areas. Use properly maintained foot baths containing a germicidal agent at entrances if possible.
9. When collecting cuttings in the field, inspect stock plants carefully, and avoid any plants showing disease symptoms or abnormalities. For many leaf diseases, inspect stock plants late in the growing season before cuttings are actually to be taken, when leaf diseases are most apparent.

3.3 Diseases of General Importance or Occurrence

Because of the large number of crops covered in this document, and the wide variety of diseases that affect them, this section covers those diseases that have a broad host range and are most common in nurseries and landscapes.

3.3.1 Crown Gall

Crown gall, caused by Agrobacterium tumefaciens, occurs in nurseries and plantings throughout New York State. The list of woody plants susceptible to the disease includes plants in at least 77 genera and 32 families.

The disease becomes established in nursery crops when clean stock is planted in infected soil and when infected stock is planted in previously clean soil. Once in the soil, the bacteria can persist indefinitely in decomposing debris from galls on susceptible plants. The wounds necessary for entry of the pathogen occur during planting, cultivating, grafting, and pruning.

Table 3.3.1. Provisional List Of Woody Plant Genera Not Susceptible To Crown Gall

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berberis</td>
<td>Barberry</td>
</tr>
<tr>
<td>Buxus</td>
<td>Boxwood</td>
</tr>
<tr>
<td>Carpinus</td>
<td>Hornbeam</td>
</tr>
</tbody>
</table>
### 3.4.1. Disease control guide

**NOTE:** See Section 3.5 for pesticide trade names containing the active ingredients noted below. Pesticides listed in this table may not be registered for both nursery and landscape use. Always confirm that the site you plan to treat and the pest you wish to control are listed on the label before using any pesticide.

**Symbols Used:** * = Restricted-use pesticide; † = Not for use in Nassau and Suffolk Counties; ‡ = Trade names are listed when: (a) two active ingredients are combined into one product or (b) where only one or two labels within a larger list of products are registered for that pest and host.

<table>
<thead>
<tr>
<th>Plant and Disease¹</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pyracantha</strong> <em>(firethorn) (continued)</em></td>
<td>Fire blight <em>(continued)</em></td>
</tr>
<tr>
<td>CuPRO 5000‡, Kocide HCu, or copper sulfate pentahydrate three times at 10- to 14-day intervals beginning when plants flower, or inject Tree Tech OTC‡ per label directions, or use an appropriate formulation of one of the mono- and di-potassium salts of phosphorus acid for the site. Hybrids reported to be resistant include ‘Apache’, ‘Navaho’, ‘Pueblo’, ‘Rutgers’, ‘Shawnee’, and ‘Teton’.</td>
<td></td>
</tr>
</tbody>
</table>

| Scab caused by *Venturia pyracanthae* *(Plate 44, 43)* | Spray with Protect DF‡, thiomannate-methyl, potassium bicarbonate, neem oil, *Junction‡, CuPRO 5000‡, Kocide HCu, *Pageant Intrinsic‡, or *Spectro 90 WDG‡ at full bloom and two and four weeks later. Yunan firethorn *(P. crenato-sessata)* is reported to be resistant. |

| **Pyrus** *(pear)* | Fire blight caused by *Erwinia amylovora* *(Plates 76, 77, 187)* |
| Prune out diseased parts when plants are dry, disinfecting tools between cuts. Make cuts several inches below visible limits of infection. Remove worthless pear, apple, and quince from the vicinity. The Bradford pear *(Pyrus calleryana cv. ‘Bradford’) is reported to be tolerant. P. *beautifolia ‘Dancer’* is resistant. Where severe treat with fosetyl-Al (for suppression), *Junction‡, CuPRO 5000‡, Kocide HCu, or copper sulfate pentahydrate per label directions, or use an appropriate formulation of one of the mono- and di-potassium salts of phosphorus acid for the site. Tree Tech OTC‡ is labeled for use as an injection to suppress this disease. |

| Scab caused by *Venturia pyrina* *(= Fusicladium sp.)* *(Plate 44, 43)* | Spray with *Pageant Intrinsic‡, thiophanate-methyl, myclobutanil or mancozeb per label directions. |

| Pear trellis rust caused by *Gymnosporangium sabinae* | Spray with mancozeb, myclobutanil, *Pageant Intrinsic‡, *Mural‡, or thiophanate-methyl on a 7-21 day interval or per label directions. |

| Other rust caused by *Gymnosporangium* spp. *(Plates 117–120, 129-133)* | Eliminate nearby red cedar and *Juniperus chinensis* to whatever extent practical. Spray with myclobutanil or thiophanate-methyl when orange rust masses appear on juniper and thereafter at 7- to 14-day intervals or per label directions. |

| **Quercus** *(oak)* | Anthracnose of white oak caused by *Apiognomonia* sp. *(Plate 50, 49)* *(conidial state = Discyla* sp.)* |
| Destroy fallen leaves in autumn. Spray with Protect DF‡, elemental copper (with lime), *Junction‡, or *Spectro 90 WDG‡ once before budbreak, once at budbreak, and once when leaves are half of full size, or use *Fungisol w/debacarb‡ for injection in the spring. |

| Leaf spot caused by *Tubakia dryina* *(Plate 21)* | This disease develops late in the growing season and rarely threatens tree health. Where management must be undertaken, use *Junction‡ or CuPRO 5000‡, or spray with propiconazole once at budbreak and twice thereafter at 10- to 14-day intervals. |

| Leaf blister caused by *Taphrina caerulescens* *(Plate 6, 2)* | This disease rarely is severe enough to affect host health or appearance. Where it has become so, spray once in spring before bud swell with mancozeb, *Junction‡, or *Spectro 90 WDG‡. |

| Oak Wilt caused by *Ceratocytis fagacearum* *(Plate 118)* | Although white oak and bur oak are considered to be somewhat resistant, this disease can infect all oak species common in NYS and may kill trees in the red oak group within weeks or months of infection. If Oak Wilt is confirmed, take the following steps to minimize the spread of the fungus. |

1. Examine oaks on your property regularly, paying special attention to red oaks with rapidly wilting leaves in June or July. |
2. Remove diseased trees immediately and take steps to ensure that the wood dries quickly enough to minimize formation of sporulating mycelial mats. |
### Table 3.5.1. Some fungicides, bactericides, and nematicides registered for use on trees and shrubs in New York State

**Symbols Used:** * = Restricted-use pesticide; † = Not for use in Nassau or Suffolk Counties; ‡ = Site use: N = Nursery (may include field grown and plantation-grown), L = landscape (may include residential or commercial landscapes); § = REI = restricted-entry interval; applies to nursery (or plantation) uses under the Worker Protection Standard, 40 CFR part 170; NA = not applicable

<table>
<thead>
<tr>
<th>Active Ingredient (Mode of Action Group)</th>
<th>Example Trade Names, Formulation (Company)</th>
<th>EPA Reg. No.</th>
<th>Use ‡</th>
<th>REI§</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Myclobutanil (3)</strong></td>
<td>*Eagle 20 EW (Corteva)</td>
<td>62719-463</td>
<td>N, L</td>
<td>24</td>
</tr>
<tr>
<td>Broad-spectrum fungicide for control of leaf, flower, and twig blights. <strong>Note:</strong> Not approved for use on landscape, nursery, or greenhouse ornamentals in Nassau and Suffolk Counties, New York.</td>
<td></td>
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</tr>
<tr>
<td><strong>Myrothecium Verrucaria, Dried Fermentation Solids and Solubles (NC)</strong></td>
<td>DiTera DF (Valent)</td>
<td>73049-67</td>
<td>N</td>
<td>4</td>
</tr>
<tr>
<td>Nematicide for pre-plant, planting, and post-plant suppression of labeled nematode species.</td>
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</tr>
<tr>
<td><strong>Neem Oil, Clarified Hydrophobic (NC)</strong></td>
<td>Triact 70 (OHP)</td>
<td>70051-2-59807</td>
<td>N, L</td>
<td>4</td>
</tr>
<tr>
<td>For control of black spot of rose, powdery and downy mildews, scab, and rust on many plant species. <strong>Note:</strong> Do not apply to rose blossoms or to other sensitive plants listed on label. Follow label directions to avoid making applications that may cause phytotoxicity.</td>
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<tr>
<td><strong>Oxystetracycline Calcium Complex (41)</strong></td>
<td>*Tree Tech OTC (Florida Silvics)</td>
<td>64014-11</td>
<td>N, L</td>
<td>0</td>
</tr>
<tr>
<td>For injection to suppress Bacterial Leaf Scorch (Xylella) in Oak and Vascular Yellows in Ash and Elm and Fire Blight in labeled hosts.</td>
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<tr>
<td><strong>Potassium Bicarbonate (NC)</strong></td>
<td>Milstop SP (BioWorks)</td>
<td>68539-13</td>
<td>N, L</td>
<td>1</td>
</tr>
<tr>
<td>Kaligreen (Oat Agrio)</td>
<td>11581-2</td>
<td>N</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Fungicide for control of powdery mildew and Botrytis on a wide variety of plants and additional pathogens per individual labels. Kaligreen labeled for powdery mildew only.</td>
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</tr>
<tr>
<td><strong>Propamocarb Hydrochloride (28)</strong></td>
<td>Banol Fungicide (Bayer)</td>
<td>432-942</td>
<td>N</td>
<td>24</td>
</tr>
<tr>
<td>Banol T&amp;O Fungicide (Bayer)</td>
<td>432-942</td>
<td>N</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Fungicide for control of <em>Phytophthora</em> on woody ornamentals grown in greenhouses or in pots in nurseries. Not for use on field grown ornamentals.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Propiconazole (3)</strong></td>
<td>*Alamo Fungicide (Syngenta)</td>
<td>100-741</td>
<td>L</td>
<td>NA</td>
</tr>
<tr>
<td>Dorado Fungicide (Syngenta)</td>
<td>100-741</td>
<td>N, L</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>*Quali-Pro Propiconazole 14.3 (Control Solutions)</td>
<td>53883-363</td>
<td>N, L</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>*Shepherd Fungicide (ArborSystems)</td>
<td>69117-3</td>
<td>N</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Lesco Spectator T&amp;O Fungicide (Nufarm)</td>
<td>228-633</td>
<td>N, L</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Lesco Spectator Ultra 1.3 (Lesco)</td>
<td>228-623-10404</td>
<td>N, L</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Systemic fungicide for control of many foliar diseases. Alamo and Shepherd usually applied via specific trunk/root flare injection systems. Special training in injection techniques required. Root flare injections of Spectator Ultra 1.3 are not registered for use in NY.</td>
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</tr>
<tr>
<td><strong>Pyraclostrobin (11) + Boscalid (7)</strong></td>
<td>*Pageant Intrinsic (BASF)</td>
<td>7969-251</td>
<td>N, L</td>
<td>12</td>
</tr>
<tr>
<td><strong>Warning:</strong> Pyraclostrobin is of the strobilurin chemical class. To discourage development of resistant pests, alternate sprays with another product that has a different mode of action as directed on the label.</td>
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</tr>
<tr>
<td><strong>Thiabendazole Hypophosphite (1)</strong></td>
<td>*Arbotect 20-S (Syngenta)</td>
<td>100-892</td>
<td>N, L</td>
<td>0</td>
</tr>
<tr>
<td>Systemic fungicides for injection into elms for Dutch Elm Disease, and Sycamore Anthracnose control. Special training in injection techniques required.</td>
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</table>
4 Weed Management in Nursery Crops

4.1 Establishing a Weed Management Program

4.1.1 The Need for a Weed Management Program

Weeds compete with crop plants for water, fertilizer, light, carbon dioxide, and other resources essential for plant growth. Weeds also harbor insect pests; reduce air flow around desirable plants, resulting in a microclimate more conducive to disease; and in some instances, serve as alternate hosts to pathogenic organisms. In addition, the aesthetic quality of the landscape (and perceived quality of nursery stock) is reduced by weed growth. Consequently, weed management is an essential part of any nursery crop production or landscape management system.

4.1.2 Weed Identification

The first step in developing any pest management plan is to identify the pest, and a weed management program is no exception. The importance of proper identification cannot be overemphasized. Correct identification not only means knowing the proper name but also provides information about the weed, particularly its life cycle. Weeds that infest ornamental plantings have one of four life cycles. Becoming familiar with the life cycle allows us to determine at what time of year the most susceptible growth stage is occurring. Summer annuals emerge in the spring, flower, and set seed before the first frost in the fall. Winter annuals germinate at the end of summer and overwinter as small, dormant seedlings. Biennials are similar to winter annuals but germinate earlier in the summer. As days lengthen and temperatures rise in the spring, both winter annuals and biennials are stimulated to flower, set seed, and die before the end of the summer. Perennials, as the name suggests, survive more than two seasons and generally can propagate by seed or by vegetative means. Weeds can also be classified into broad categories based on their growth types—grasses, sedges, and broadleaves—that are often useful in determining herbicide selectivity. Several weed and wildflower identification guides are available to assist in this identification effort. For a list of such resources appropriate to your region or for help in identifying unknown species, contact your local Cornell Cooperative Extension office (cce.cornell.edu/localoffices).

4.1.3 Weed Scouting

Scouting fields for weeds should begin the year before planting, paying particular attention to species that will be difficult or impossible to control after planting. These species must be controlled before planting. Integrating crop planting maps with weed maps has provided optimal weed control and reduced crop injury from inappropriate herbicide use, excessive cultivation, or weed competition for crop and weed management groupings. After planting, fields should be scouted at least twice a year: early summer and early autumn. In early summer, any summer annual weeds that escaped control are still small but identifiable and may be controlled with cultivation or selective postemergent herbicides. Also at this time, many winter annuals and biennials are flowering so there still may be time to control them before seeds ripen. Perennial weeds may be identified and mapped early in the season to allow optimal timing of control procedures. Some perennials, such as quackgrass, are best controlled early in the season, whereas others are best controlled at other times. (See Table 4.2.1 for specific guidelines for perennial weed control.) In early autumn, winter annual seedlings, perennial weeds, and summer annuals that escaped control procedures are identifiable. Winter annuals will be easier to control postemergently at this time, before they have overwintered. The results of the autumn scouting are also useful in evaluating the effectiveness of your overall weed management program.

The actual scouting process can be accomplished in a fairly simple manner. The first and most important aspect is to map the areas, noting the species and locations of weeds as well as the species of ornamentals present. Many nurseries have already developed planting maps that may be adapted to this purpose. Using this map, conduct a weed inventory of each growing area or block. Walking fields in a wide zigzag pattern is an efficient way to do this. Note the general weed population and record relative densities. Take particular note of heavy infestations of a single species, perennial weeds, species you do not know (could this be a serious weed in the future?), and weeds that may be new to the area. As this inventory of information builds, notice which species are not controlled by your current management program, for these species will become more numerous unless you alter your management program to compensate.

4.1.4 Weed Management Options

Plan your weed management strategy based on the scouting report. Perennial weeds and other difficult-to-control species should be controlled before planting. Also before planting, consider the postplanting weed management strategies to be employed. Doing this before planting may help avoid costly weed problems later on. After planting, weeds may be controlled with cultivation, mulches, cover cropping (or living mulches), or herbicides. A combination of these control strategies, coupled with cultural programs that minimize weed infestations and introductions, is generally the most practical and effective option. When selecting the most appropriate options, consider the economics, crop safety, efficacy, environmental stewardship, and “fit” within your overall crop management program.
4.8 Description and Characteristics of Herbicides Registered for Nursery and Landscape Use

**Acclaim Extra**

*Common Name:* fenoxaprop  
*Formulation:* 0.57EC

**Uses:** Postemergence control of annual and perennial grass weeds in established turfgrass, nursery crops, and landscape ornamentals, including many trees, shrubs, herbaceous perennials, and annuals.

<table>
<thead>
<tr>
<th>Amount of active ingredient</th>
<th>Amount by formulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.57EC</td>
<td></td>
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</tbody>
</table>

| Per Acre | 0.1 to 0.3 lb. | 3.5 to 39 oz. |
| Per 1,000 sq. ft. | 0.02 to 0.17 lb. | 0.08 to 0.90 oz. |

**Recommended rates for annual grass control:**

<table>
<thead>
<tr>
<th>Growth stage</th>
<th>oz./A</th>
<th>oz./1,000 sq. ft.</th>
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</thead>
<tbody>
<tr>
<td>seedling (untillered)</td>
<td>13</td>
<td>0.30</td>
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<tr>
<td>1–2 tillers</td>
<td>20</td>
<td>0.46</td>
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<tr>
<td>3–4 tillers</td>
<td>28</td>
<td>0.64</td>
</tr>
</tbody>
</table>

**Major Weeds Controlled:** Annual grasses such as Japanese stiltgrass, crabgrass, goosegrass, barnyardgrass, foxtails, and panicums.

**Major Weeds Not Controlled:** Annual bluegrass, broadleaf weeds, or sedges. Most perennial grasses are tolerant.

**For Best Results:** Apply to young (seedling to 3-tiller), actively growing grasses. May be tank mixed, following label directions with other pre- and postemergence herbicides. Thorough spray coverage is essential for optimal results. Flat fan nozzles are recommended. Addition of a nonionic surfactant is generally recommended.

**Cautions and Precautions:** Do not use on Bar Harbor juniper, salvia, philodendron, podocarpus, or pittosporum. Check label for other species restrictions. Weed and crop tolerance may vary according to environmental conditions, and tolerance should be determined before extensive use. Do not apply more than a total of 120 oz. per acre per growing season. Do not apply more than 28 oz./A to Kentucky bluegrass or zoysiagrass.

**Residual Activity:** Up to two weeks of residual control has been reported.

**Volatility and Leaching Potential:** Loss from volatility is minimal. Leaching is negligible.

**Symptoms and Mode of Action:** Growth inhibition occurs within 48 hr. Meristems turn black shortly thereafter. Yellow to red foliage develops in about 7 to 10 days, leading to death within about 14 days. Mechanism of action involves inhibition of lipid synthesis at the root and shoot meristems.

**Manufacturer:** Bayer Environmental Science

**EPA Reg. No.:** 432-950
### Table 4.9.1. Weed susceptibilities to PREemergence herbicides

**KEY:**
- ful = full control is expected.
- par = partial control is expected.
- no = no control is expected.

<table>
<thead>
<tr>
<th>Genus, species</th>
<th>Common name</th>
<th><em>Barricade</em></th>
<th><em>BroadStar</em></th>
<th><em>Casoron</em></th>
<th><em>Dacthal</em></th>
<th><em>Dimension</em></th>
<th><em>Fuerte</em></th>
<th>Goal 2XL</th>
<th><em>Kerb</em></th>
<th>Marengo</th>
<th>SpecTicle</th>
<th>OH2</th>
<th>Pendulum</th>
<th>Princep</th>
<th><em>Ronstar</em></th>
<th><em>Starflan</em></th>
<th>Treffan XL</th>
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</thead>
<tbody>
<tr>
<td><strong>Broadleaves (continued)</strong></td>
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<tr>
<td><em>Euphorbia hirta</em></td>
<td>spurge, garden</td>
<td>ful</td>
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<tr>
<td><em>Euphorbia maculata</em></td>
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<td>ful</td>
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<td>ful</td>
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<tr>
<td><em>Euphorbia spp.</em></td>
<td>spurge</td>
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<tr>
<td><em>Euphorbia supina</em></td>
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<td>ful</td>
<td>par</td>
<td>ful</td>
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<td><em>Galinsoga ciliata</em></td>
<td>galinsoga, hairy</td>
<td>ful</td>
<td>no</td>
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<tr>
<td><em>Gallium aparine</em></td>
<td>bedstraw, catchweed</td>
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<tr>
<td><em>Gnaphalium falcatum</em></td>
<td>cudweed, narrowleaf</td>
<td>ful</td>
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<tr>
<td><em>Gnaphalium spp.</em></td>
<td>cudweed</td>
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<td>par</td>
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<tr>
<td><em>Hypochoeris radicata</em></td>
<td>catsear, spotted</td>
<td>ful</td>
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<tr>
<td><em>Ipomea hederacea</em></td>
<td>morningglory, ivyleaf</td>
<td>ful</td>
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<td>par</td>
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<td>ful</td>
<td>ful</td>
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<tr>
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<tr>
<td><em>Lepidium perfoliatum</em></td>
<td>pepperweed, yellowflower</td>
<td>ful</td>
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<tr>
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<td>ful</td>
<td>ful</td>
<td>ful</td>
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<tr>
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<td><em>Marchantia spp.</em></td>
<td>liverwort</td>
<td>ful</td>
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<tr>
<td><em>Matricaria matricarioides</em></td>
<td>pineappleweed</td>
<td>ful</td>
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<td>ful</td>
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<tr>
<td><em>Medicago hispita</em></td>
<td>burclover</td>
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<tr>
<td><em>Medicago lupulina</em></td>
<td>medic, black</td>
<td>ful</td>
<td>ful</td>
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<td><em>Mollugo verticillata</em></td>
<td>carpetweed</td>
<td>ful</td>
<td>ful</td>
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<tr>
<td><em>Montia perfoliata</em></td>
<td>lettuce, miners</td>
<td>ful</td>
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<tr>
<td><em>Moss (several genera)</em></td>
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<tr>
<td><em>Oenothera laciniata</em></td>
<td>eveningprimrose, cutleaf</td>
<td>ful</td>
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<tr>
<td><em>Oenothera spp.</em></td>
<td>eveningprimrose</td>
<td>ful</td>
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<tr>
<td><em>Oxalis corniculata</em></td>
<td>wood sorrel, creeping</td>
<td>ful</td>
<td>ful</td>
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<tr>
<td><em>Oxalis stricta</em></td>
<td>wood sorrel, yellow</td>
<td>ful</td>
<td>ful</td>
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<tr>
<td><em>Physalis spp.</em></td>
<td>ground cherry</td>
<td>ful</td>
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<tr>
<td><em>Plantago spp.</em></td>
<td>plantain species</td>
<td>ful</td>
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<tr>
<td><em>Polygonum aviculare</em></td>
<td>knotweed, prostrate</td>
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<tr>
<td><em>Polygonum convolvulus</em></td>
<td>buckwheat, wild</td>
<td>ful</td>
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<tr>
<td><em>Polygonum pensylvanicum</em></td>
<td>smartweed, Penn.</td>
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<td><em>Polygonum persicaria</em></td>
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<td>ful</td>
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<td>ful</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><em>Portulaca oleracea</em></td>
<td>purslane, common</td>
<td>ful</td>
<td>ful</td>
<td>ful</td>
<td>ful</td>
<td>ful</td>
<td>ful</td>
<td>ful</td>
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<td>ful</td>
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<tr>
<td><em>Raphanus raphanistrum</em></td>
<td>radish, wild</td>
<td>ful</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td><em>Richardia scabra</em></td>
<td>pusley, Florida</td>
<td>ful</td>
<td>ful</td>
<td>ful</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><em>Rumex acetosella</em></td>
<td>sorrel, red</td>
<td>ful</td>
<td></td>
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<td></td>
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<tr>
<td><em>Rumex crispus</em></td>
<td>dock, curly</td>
<td>ful</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td><em>Sagina procumbens</em></td>
<td>pearlwort, birdeye</td>
<td>ful</td>
<td>ful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td><em>Salsola kali</em></td>
<td>thistle, Russian</td>
<td>ful</td>
<td>ful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

2022 CORNELL PEST MANAGEMENT GUIDE FOR COMMERCIAL PRODUCTION AND MAINTENANCE OF TREES AND SHRUBS
### Table 4.10.1 Herbicides registered for use on ornamentals in New York

**Key:** Ornamental Species: Several = 6 species or more registered; Few = 1-4 species registered; None = 0 species registered  
\( f/c = \) field and container  
\( c = \) container use only  
\( t = \) field  
* Restricted-use pesticide  
† = Not for use in Nassau or Suffolk Counties  

<table>
<thead>
<tr>
<th>Application Type</th>
<th>Long Island Use?</th>
<th>Trade Name</th>
<th>Shade Trees</th>
<th>Narrow Leaf (Needle) Evergreens</th>
<th>Broadleaf Evergreens</th>
<th>Deciduous Shrubs</th>
<th>Groundcovers (Woody &amp; Semi-Woody)</th>
<th>Perennials (Herbaceous)</th>
<th>Ornamental Grasses</th>
<th>Bulbs</th>
<th>Annuals (Bedding Plants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pre yes</td>
<td>Pendulum</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
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<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
</tr>
<tr>
<td>pre no</td>
<td>*Pennant Magnum</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
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<td>Several (f/c)</td>
<td>Several (f/c)</td>
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<tr>
<td>post directed</td>
<td>Roundup Pro</td>
<td>Several (f)</td>
<td>Several (f)</td>
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<td>None</td>
<td>None</td>
<td>None</td>
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<td>None</td>
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<tr>
<td>post directed</td>
<td>Scythe</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>Several (f)</td>
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<td>Several (f)</td>
<td>Several (f)</td>
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<tr>
<td>post directed</td>
<td>Sedgehammer+</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>pre yes/no</td>
<td>*Simazine (several)</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>Several (f)</td>
<td>Few (f)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>pre yes</td>
<td>*Sureguard</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
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<td>None</td>
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<tr>
<td>pre yes</td>
<td>Surflan</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
<td>Several (f/c)</td>
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<td>Several (f/c)</td>
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<tr>
<td>pre yes</td>
<td>Treflan</td>
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<td>Several (f/c)</td>
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</tr>
<tr>
<td>pre yes</td>
<td>XL 2G</td>
<td>Several (f/c)</td>
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<td>Several (f/c)</td>
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</table>

### Table 4.10.2 Herbicides registered for landscape use in New York State

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Common Name</th>
<th>Spray or Granular</th>
<th>Pre or Post</th>
<th>Plant Types that may be found on the Label</th>
<th>Weeds Controlled</th>
<th>Application</th>
<th>Post-Plant Interval</th>
<th>Residential landscape restrictions³</th>
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</thead>
<tbody>
<tr>
<td>Acclaim Extra</td>
<td>fenoxaprop</td>
<td>S</td>
<td>post</td>
<td>Turf</td>
<td>ann grasses</td>
<td>OT</td>
<td>Established</td>
<td></td>
</tr>
<tr>
<td><strong>Barricade 4L</strong></td>
<td>prodiamine</td>
<td>S</td>
<td>pre</td>
<td>Annuals Perennials Trees &amp; Shrubs Orn. Grasses</td>
<td>ann grass &amp; bl weeds</td>
<td>OT</td>
<td>Newly planted (after soil settles)</td>
<td></td>
</tr>
<tr>
<td><strong>Barricade 65WG</strong></td>
<td>prodiamine</td>
<td>S</td>
<td>pre</td>
<td></td>
<td>ann grass &amp; bl weeds</td>
<td>OT</td>
<td>Newly planted (after soil settles)</td>
<td></td>
</tr>
<tr>
<td>Barrier</td>
<td>dichlobenil</td>
<td>G</td>
<td>pre</td>
<td>can injure turf</td>
<td>ann &amp; per grass &amp; bl weeds</td>
<td>D</td>
<td>Established</td>
<td></td>
</tr>
<tr>
<td>BasagranT&amp;O</td>
<td>bentazon</td>
<td>S</td>
<td>post</td>
<td></td>
<td>bl weeds &amp; sedges</td>
<td>D or OT</td>
<td>Label does not specify</td>
<td></td>
</tr>
<tr>
<td>Biobarrier¹</td>
<td>trifluralin</td>
<td>Geo-textile</td>
<td>pre</td>
<td></td>
<td>roots</td>
<td>Under surface</td>
<td>None</td>
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</tr>
<tr>
<td><strong>BroadStar</strong></td>
<td>flumioxazin</td>
<td>G</td>
<td>pre</td>
<td></td>
<td>ann grass &amp; bl weeds</td>
<td>OT</td>
<td>Established</td>
<td></td>
</tr>
</tbody>
</table>
5 Vertebrate Pest Management

5.1 Integrated Pest Management (IPM)
No single, simple remedy can be relied on to solve rodent problems in a sustainable way. Rodent control must be considered in terms of the environment in which the pest is active. Control activities must have as an overriding principle the biology and behavior of the animal in concert with its whole environment. IPM is a holistic, decision-making system – a process in which all interventions are brought to bear on a pest problem with the goal of providing the most effective, economical, and safe program possible. In short, IPM is a process for determining if, where, when, and what pest management intervention(s) are needed or justified.

5.2 Nonchemical Wildlife Damage Management Alternatives
A nursery owner can use a variety of nonchemical alternatives to reduce wildlife damage to nursery stock and ornamental shrubs. These techniques fall into several broad categories: exclusion, habitat modification, and wildlife population reductions. Although exclusion and habitat modification appear to be more expensive than population control, where possible, they may provide the greatest efficacy and longer-term relief from damage problems.

5.2.1 Exclusion
Fencing is the most reliable exclusion technique for preventing wildlife damage to nursery stock. Woven-wire designs are the most effective physical barrier to wildlife, with high-tensile woven-wire fencing providing the ultimate in protection and durability. Deer can be successfully eliminated from large areas (>50 acres) with an 8- to 10-foot woven-wire fence. The advantages of this design are its effectiveness and low maintenance requirements after construction. Disadvantages include the high initial cost and the difficulty in repairing damaged sections.

A variety of multi-strand, high-tensile, vertical or sloped, electric fence designs effectively exclude wildlife. Electric high-tensile fences may be complete physical barriers or, more commonly, may act as a behavioral deterrent. Deer can be excluded from crops with a 5- to 6-foot electric fence, even though they can easily jump over woven-wire fences of this height. The most frequent reasons why electric fences fail to prevent wildlife damage include the selection of an unsuitable fence design, failure to install fencing according to manufacturers’ specifications, and inadequate maintenance. Electric fences will not exclude wildlife unless adequate voltage is constantly maintained on the wires. High-tensile electric fences are easily repaired and may cost half as much as 8- to 10-foot woven-wire designs. Disadvantages include frequent monitoring and the need for vegetation control to maintain shocking power.

Other physical barriers that can prevent wildlife damage include wire cages, plastic tubing, bud caps, and bird netting. Large-scale use of these materials may be uneconomical because of the labor required to apply and remove these barriers. Wire or plastic tree guards can be used to protect trees from trunk girdling by rodents or rabbits. The more expensive wire guards provide longer-term damage prevention.

5.2.2 Habitat Modification
Habitat modifications can make areas less suitable for nuisance wildlife. Damage prevention with cultural manipulations should begin with site selection and plant establishment. In nurseries, plowing or diskjng reduces vole populations, facilitates the establishment of the desired cover crop between rows, and simplifies future vegetation control. Removal of brush, stone piles, and nonmowable wet areas will reduce the attractiveness of sites to rodents and rabbits. Mowing in established plantings can reduce preferred wildlife foods, remove protective cover, enhance predation, and expose animals to severe weather conditions. Sites adjacent to croplands should also be mowed to reduce pest numbers.

5.2.3 Population Reduction
Wildlife population reductions may be necessary to reduce damage to tolerable levels. Snap-back or cage traps are effective for capturing small mammals. Larger rodents or carnivores can be caught with foothold or body-gripping traps. When trapping, care and experience are necessary to reduce captures of nontarget species. In more urban areas, live-capture cage traps are recommended to protect pets. In rural locations, shooting can be used to effectively remove problem animals.

A trapping license, small game license, or special permit may be required from the New York State Department of Environmental Conservation (DEC) for lethal control or transport of vertebrate pests. County and local laws vary in New York State, and some areas have trapping or shooting restrictions. Contact state and local officials before implementing any lethal or trapping and removal program for nuisance wildlife.

Reducing animal numbers by lethal methods may fail to provide long-term relief from damage. Where habitat conditions are suitable and exclusion is not attempted, most pest species will repopulate the site soon after control efforts have ceased, as animals will move into the control area from adjacent lands. Habitat modification and exclusion methods often require more initial effort and expense, but these techniques may provide longer-term damage prevention, especially when a few pest individuals can inflict substantial losses.