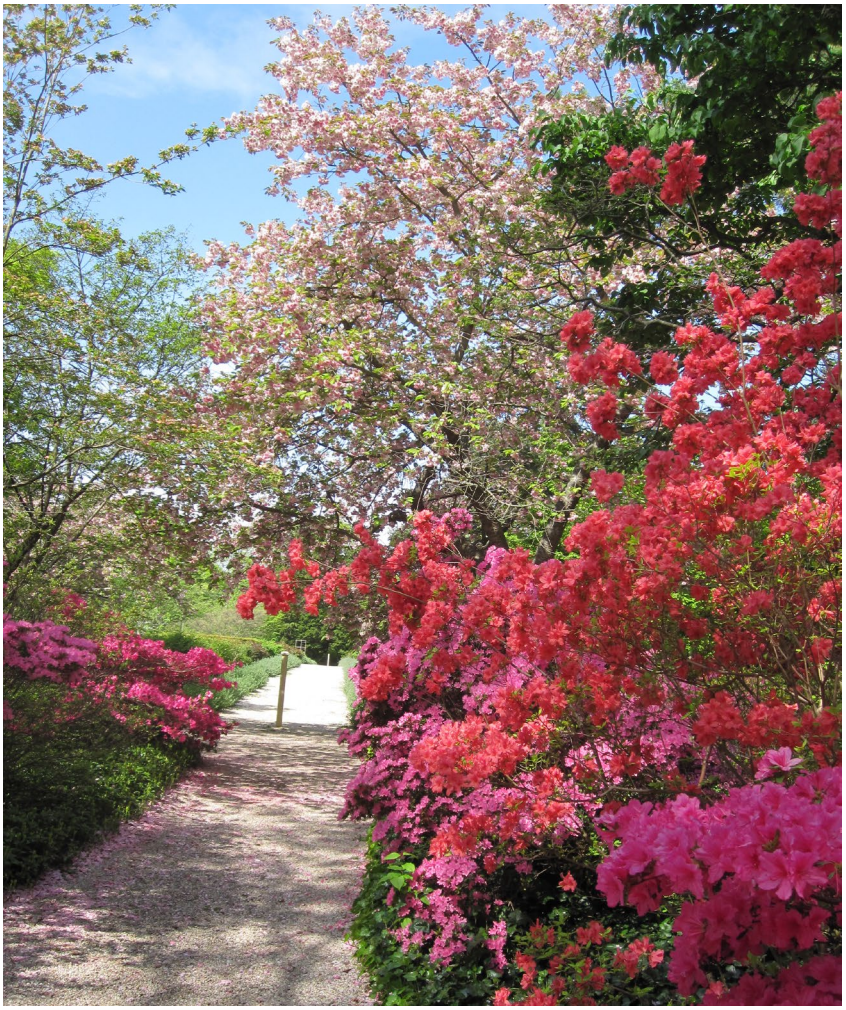

2025
Cornell Pest Management Guide for Commercial Production and Maintenance of Trees and Shrubs

Cornell Cooperative Extension

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

2025 Cornell Pest Management Guide for Commercial Production and Maintenance of Trees and Shrubs

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Abbreviations and Symbols Used in This Publication

A.....acre, aerosol	EC, EW emulsifiable concentrate	ULV ..... ultra-low volume
ACS.....microencapsulated in aqueous suspension	F, FL ... flowable	W ..... wettable
AI .....active ingredient	G, GR .. granular	WDG.... water-dispersible granule
CS.....concentrate suspension	L ..... liquid	WG ..... water-dispersible granule
D .....dust	P ..... pellets	WP ..... wettable powder
DF .....dry flowable	S ..... soluble	WSB .... water soluble bag
DG .....dispersible granule	SC ..... soluble concentrate	WSP ..... water soluble packet, water soluble powder
E .....emulsion, emulsifiable	SP ..... soluble powder	

* ..... Restricted use pesticide
*[F] ..... Indicates a federally restricted use pesticide
† ..... Not for use in Nassau and Suffolk Counties

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 May 2025). Changes in pesticide registrations, regulations, and guidelines occurring after publication are available in county Cornell Cooperative Extension offices or from the Cornell IPM Pesticide Safety Program (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: *Dawn Dailey O'Brien.*

1 Pesticide Information

1.1 Pesticide Classification and Certification

Pesticides can be classified as general use or restricted use. **General use pesticides** may be purchased and used by anyone. **Restricted use pesticides** can only be purchased and used by a certified applicator or used by someone under a certified applicator's supervision. In some cases, the pesticide label may limit use of a restricted use pesticide to only a certified applicator.

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. If a private applicator wants to use or supervise the use of restricted use pesticides, they need to be a **certified private applicator**. Certified private applicators are also allowed to purchase restricted use pesticides. Certification is not needed if a private applicator uses general use pesticides.

In New York State, a **certified commercial applicator**, **certified commercial technician**, or **commercial apprentice** working under the supervision of a certified commercial applicator is allowed to apply any type of pesticide on property that is not a private application (described above) or is a residential application. (A residential application is the use of general use pesticides on property owned or rented by the applicator, excluding establishments selling or processing food and residential structures other than where the applicator lives.) Certified commercial applicators are allowed to purchase restricted use pesticides.

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

1.2 Use Pesticides Properly

Using pesticides requires the user to protect their health, the health of others, and the environment. Keep in mind "pesticide use" is more than just the application. It 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 also require you to comply with state and federal laws and regulations intended to protect human health and the environment from the adverse effects pesticides may cause.

1.2.1 Plan Ahead

Many safety precautions should be taken *before* you begin using pesticides. 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 label directions and precautions. 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

Transporting pesticides carelessly can result in broken containers, spills, and contamination of people and the environment. Accidents can occur even when transporting pesticides 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 (PPE) needs depend on the pesticide being handled. **Required PPE are listed on pesticide labels.** Any required PPE is based on the pesticide's toxicity, route(s) of exposure, and formulation. Label-listed PPE are the minimum that must be worn when using a pesticide. You can always use more than what's listed!

The type of PPE used depends on the type and duration of the activity, where pesticides are being used, and the user's exposure. For example, mixing/loading procedures often require more PPE than when applying a pesticide. Studies show you are at a greater risk of accidental poisoning when handling pesticide concentrates. Pouring pesticide concentrates is the most hazardous activity.

Engineering controls are devices that help reduce a pesticide user's exposure. An example is a closed transfer system that reduces the exposure risk when dispensing pesticide concentrates. 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 non-target areas, and harm the environment. Choose weather conditions, pesticides, application equipment, pressure, droplet size, formulations, and adjuvants to minimize drift and runoff potential. Product labels may have specific application and/or equipment requirements to reduce issues with drift and runoff.

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 Ornamentals – 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 *New York and New England Management Guidelines for Greenhouse Floriculture and Herbaceous Ornamentals*. 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-pmep-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 roguing of sick plants. Traps using food baits, light, and

petroleum solvents and fuels, and herein lies the matter of phytosafety. See Table 2.6.1.

During refinement, the temperature of the second distillation determines the range of final product uses. A narrow distillation temperature range, from about 400°F to 435°F, yields horticultural oil suitable for application to green, verdant plants. Distillation temperatures above 435°F produce oils suitable for use on plants only in a dormant condition. Only certain oils are suitable for application to plants under summer growing conditions; these are identified in Table 2.7.1. Summer-use oils generally include dormant-stage directions as well, usually with a higher application rate. The same oil (e.g. Sunspray 6E) may be sold by different companies under various brand names and is sometimes marketed for year-round (summer and dormant) use in one package or only for dormant stage application in another. In a few cases, oil in the container may even come from different refiners in different years; price determines source. Check labels carefully to see if summer uses are permitted. For "green industry" users, a "summer" oil is often the more useful oil product because it can be used in dormant applications by increasing the dosage. One oil tested under a great variety of summer conditions has the trade name Ultra-fine (Tables 2.6.2, 2.7.1). It can be used on fruits, vegetables, flowering annuals, foliage plants, trees, and shrubs, and in both field-grown and greenhouse conditions with a wide range of pesticide efficacy targeting major species of plant-feeding mites, aphids, adelgids, psyllids, lace bugs, certain leafhoppers, mealybugs, scales, whiteflies, certain plant bugs, and thrips. Chewing insects, primarily those in immature stages (caterpillars, leaf beetles, and sawflies), are also killed. Horticultural oil is also effective against some powdery mildews.

Horticultural mineral oils have been extraordinary pest management tools, especially for IPM systems. In addition to having low acute toxicity for humans, the dilute oil spray generally presents low exposure risk to mammals, birds, and most other vertebrates. It is highly lethal to a wide range of insects and mites on contact, however, with good compatibility for insect parasites and predators. Timing of summer oil sprays to protect active adult parasites may require adjusting the spray date as little as one day. Direct spray contact with predatory beetles such as adult lady beetles appears to have no deleterious effect.

Oils are most useful as summer sprays. Oils developed for summer use are as safe to plants as most of the synthetic organic insecticides. Research conducted on the verdant oils is finding additional uses in terms of the range of insects and mites controlled. Up to four applications of oil may be made safely during the growing season.

Some caution is advised concerning safety of oils to plants. Risk of plant injury may be increased when oil is combined with certain other pesticides (e.g., chlorothalonil (Daconil, Bravo, Manicure), dimethoate, carbaryl, sulfur; see labels for others). Oil should not be applied during periods of high temperature, humidity, and/or drought stress. Although a wide variety of plants have been evaluated, certain plants may be sensitive, and some labels suggest using lower rates or testing first on *Cryptomeria* (Japanese cryptomeria), *Cotinus* (smoke tree), *Chamaecyparis* (falsecypress), juniper, *Ilex crenata* (Japanese holly), and spruce. Eastern redcedar (*Juniperus virginiana*) and Douglas fir (*Pseudotsuga menziesii*) may be sensitive, as is walnut *(Juglans* spp.) foliage. If very young foliage is present, lower label rates are suggested. Avoid using oil at frequent intervals, at excessive rates, and when there is risk of freezing within a day or two of application. Oil application causes blue, glaucous foliage to turn green. New, unsprayed growth will again have the blue coloration.

There is limited information on safety of fall dormant applications. In our trials, October applications of 3 percent oil to conifers led to injury that appeared later in winter or in early spring. Although some arborists have applied oil in November to deciduous trees without damage, some labels advise using lower rates and applying the oil only to certain species. Until research provides clearer guidelines, it is suggested that early spring dormant applications are a better choice than fall dormant applications.

Oil synergizes some of the organic pesticides and has been shown to enhance penetration through the waxy layer of cuticle on a leaf. Such features are particularly advantageous when using such systemic insecticides or fungicides. Oil reportedly increases surface residues of insecticides and therefore their efficiency by countering volatility, protecting against sunlight degradation, and retarding removal by rainfall. When used alone or in combination, oil also acts as an antidesiccant, improving the plant's ability to conserve moisture, a feature very important in seasons of drought.

As presently understood, oil sprays must be used on a high-volume basis. If a target pest feeds on both surfaces of a leaf, the spray must wet both sides. To reach the under-surface of leaves, it is more efficient to start spraying inside the tree canopy and work out. Anything less than complete coverage may result in poor control. Other mechanics of the spray operation are also different. Under summer conditions, water-miscible oil will separate quickly if the hose lines are left idle for as little as 15 minutes, especially when fully exposed to the heat of pavement and direct sunlight. When the spraying is resumed after such a delay, globules of pure oil will strike the target plant with the potential for severe phytotoxic reaction. It is best to habitually run all of the spray fluid from the hose back into the tank for agitation after any delay.

2.7 Insects and Mites Destructive to Woody Ornamentals

The following table lists some of the common or key insect and mite pests of woody ornamentals. Look under the host plant involved and find the correct common name of the pest. Check Tables 2.9.1 and 2.10.1 for monitoring and management information. Numbers following the insect name indicate where additional information can be found in *Insects That Feed on Trees and Shrubs,* second edition. Illustrations (plate numbers) are in boldface type. Book is available from Cornell University Press, 800-848-6224 (U.S. & Canada) or at www.cornellpress.cornell.edu.

Table 2.7.1. Host plant guide to insect names: an aid to diagnosis and identification

Plant	Pest	Page No.	Plate No.
Andromeda	azalea bark scale	336	**160**
	azalea whitefly	318	**151**
	lace bugs	424	**204**
Apple (flowering crab)	aphids	296, 300, 316	**150**
	cankerworms	142, 44	**63, 64**
	leafhoppers	412–418	**216-218**
	leafrollers	172	**100, 101**
	oystershell scale	370	**177**
	redbanded leafroller	214	
	roundheaded appletree borer	278	**131**
Arborvitae	arborvitae leafminer	142	**14**
	arborvitae weevil	240	**244**
	bagworm	176	**80**
	black vine weevil	240	**112, 113**
	Fletcher scale	98	**42**
	gypsy moth	138, 140	**61, 62**
	hemlock looper	24	
	juniper scale	106	**46**
	spruce spider mite	118	**52, 53**
Ash	blackheaded ash sawfly	134	**59**
	lace bugs	426	
	lilac/ash borer	260	**122**
	oystershell scale	370	**177**
Azalea	azalea bark scale	336	**160**
	azalea leafminer	202	**93**
	azalea whitefly	318	**151**
	black vine weevil	240	**112, 113**
	fruittree leafroller (azalea leaftier)	172	
	lace bugs	424	**204**
	rhododendron borer	258,	**121**
	rhododendron stem borer	288	
	southern red mite	475	**229**
	twobanded Japanese weevil	244	**114**
Barberry	twobanded Japanese weevil	244	**114**
Beech	aphids	296, 310	**140, 147**
	cankerworms	142–144	**63, 64**
	woolly beech aphid	296	**140**
Birch (white, gray, yellow, and European white)	aphids	296, 310	**140, 147**
	birch leafminer	184	**84**
	birch skeletonizer	220	
	bronze birch borer	272	**128**
	European hornet	494	**238**
	potato leafhopper	414	**199**
Bittersweet	euonymus scale	388	**186**

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

Host	Pest	Stage	GDD (Base 50°F)
Dormant Season (usually March or early April): No plant phenological markers offered for dormant season. *(continued)*			
Magnolia	magnolia scale	nymph	22–91
Maple	lecanium scales	adult	35–110
	maple gall mites	adult	50–148
Mountain ash	European red mite	egg	7–58
Oak	golden oak scale	adult	7–121
	kermes oak scale	adult	7–91
	lecanium scales	adult	35–110
Pachysandra	euonymus scale	adult	35–70
Pine	pine bark adelgid	immature	22–58
	pine needle scale	eggs,females	22-58
	spruce spider mite	egg	7–121
Spruce	eastern spruce gall adelgid	immature	Not Available
	spruce bud scale	immature	22–121
	spruce spider mite	egg	7–121
Tuliptree	tuliptree scale	immature	12–121
White pine	white pine aphid	egg	7–121
Willow	oystershell scale	egg	7–91
Yew	cottony taxus scale	immature	7–91
	Fletcher scale	nymph	20–60
	taxus mealybug	immature	7–91
Delayed Dormant Season, Spring			
April (early to mid-): Plants in bloom: silver maple, Cornelian cherry, pussy willow			
Cedar	pales weevil	adult	7–121
Cypress	pales weevil	adult	7–121
Elm	elm bark beetles	immature	7–120
Fir	pales weevil	adult	7–121
Hemlock	hemlock rust mite	immature/adult	7-450
	pales weevil	adult	7–122
	hemlock woolly adelgid	egg/adult	Not Available
Juniper	pales weevil	adult	7–121
Larch	pales weevil	adult	2–121
Oak	oak leaftier	larva	7–35
Pines	European pine shoot moth	larva	34–121
	pales weevil	adult	7–121
	pine bark adelgid	immature	22–58
	white pine weevil	adult	7–58
Spruce	pales weevil	adult	7–121
	white pine weevil	adult	7–58
April (late): Plants in bloom: boxelder, star magnolia, periwinkle, Norway maple			
Butternut	butternut gall mite	adult/immature	7–68
Cedar	pales weevil	adult	7–121
Cherry	tent caterpillars	larva	90–190
Cypress	pales weevil	adult	7–121
Elm	elm bark beetles	immature/adult	7–120
Fir	balsam twig aphid	nymph	58–120
	pales weevil	adult	7–121
Hemlock	hemlock rust mite	immature/adult	7–450
	pales weevil	adult	7–122
	hemlock woolly adelgid	egg/crawler	Not Available

Table 2.9.1 Insect and mite management[1]

NOTE: 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.

Symbols Used: * = Restricted use pesticide; *[F] = indicates a federally restricted use pesticide. † = Not for use in Nassau and Suffolk Counties.

Boxwood mite (229), *Eurytetranychus buxi* (spider mite) *(continued)*	
When to treat:	Horticultural oil for eggs at spring dormant. First two weeks in May, 245-600 GDD.
IPM considerations:	Japanese boxwood appears to be less susceptible.
Boxwood psyllid (137), *Psylla buxi*	
Plant abnormalities:	Upward cupped leaves.
Management options:	Acetamiprid, bifenthrin (*Talstar P, *[F]OnyxPro, *Baseline), carbaryl, cyantraniliprole, cyclaniliprole, flupyradifurone (foliar spray or container drench), horticultural oil, imidacloprid (soil drench or injection (not on Long Island)), insecticidal soap, spirotetramat (Kontos).
When to treat:	Horticultural oil for eggs at spring dormant. Spray mid- to late May, 290-440 GDD, PPI-*Laburnum alpinum,* ruby horsechestnut.
IPM considerations:	Leaf symptom remains for about two years. English boxwood is less severely attacked and damage is often ignored. Other cultivars noted as partially resistant include *B.* x 'Glencoe' ('Chicagoland Green'), *B. microphylla* 'Arborescens' and hybrids 'Green Mountain' and 'Green Velvet.' *B. microphylla* 'Sunnyside,' *B. sinica* var. *insularis* 'Winter Beauty,' and hybrids 'Green Mound' and 'Green Gem' are less preferred.
Broad mite (NA), *Polyphagotarsonemus latus* (tarsonemid mite)	
Plant abnormalities:	Stunted, deformed terminal leaves and flower buds; bronzed cupped foliage.
Management options:	Not all miticides labeled or effective. Abamectin, fenazaquin, fenpyroximate, pyridaben.
When to treat:	As damage is observed, usually from late spring on.
IPM considerations:	Broad mites have a wide host range and injury may be easily mistaken for disease or other problems. The mites are very difficult to see without magnification. Check youngest growth for mites and/or eggs to confirm.
Bronze birch borer (128), *Agrilus anxius* (beetle, flatheaded borer)	
Plant abnormalities:	Bleeding trunk, swollen areas on trunk, twig dieback, chlorotic leaves and sparse foliage.
Management options:	No effective parasites or predators under urban conditions. Acetamiprid (8.5SL, trunk spray or injection), bifenthrin (*[F]OnyxPro, *Talstar P, *Baseline), emamectin benzoate, imidacloprid (soil drench or injection (not on Long Island)), permethrin.
When to treat:	Bark sprays June, 440-880 GDD, PPI-Kousa dogwood, *Philadelphus*. Emamectin benzoate trunk injection mid- to late May. Imidacloprid soil application around mid-June has worked well.
IPM considerations:	Keep trees growing vigorously. Protect from foliage pests. Some birch species are resistant (https://hdl.handle.net/1813/56365.2). Adults begin to emerge in early June.
Calico scale (169), *Eulecanium cerasorum* (soft scale)	
Plant abnormalities:	Sooty mold, large scales encrusting twigs or young trunks. Severe infestations can lead to leaf drop, dieback, or winterkill.
Management options:	Birds and some parasitoid wasps help control. Acephate, acetamiprid (8.5SL, basal trunk spray or injection), carbaryl, cyantraniliprole, cyclaniliprole, diazinon, horticultural oil, imidacloprid (soil application), insecticidal soap, lambda-cyhalothrin, neem oil, pyriproxyfen (Distance, Defiance), spirotetramat (Kontos spray, container drench). Imidacloprid soil applications are suggested timed in early spring or late fall.
When to treat:	Mid-April to early May for dormant (oil) treatment, 35-145 GDD. Midsummer sprays for crawlers
IPM considerations:	Hosts include ornamental stone fruit, Persian walnut, elm, zelkova, maple, pyracantha, pear, *Liquidambar* spp., Boston ivy, Virginia creeper, redbud, magnolia, *Carpinus*, dogwood, buckeye, wisteria, honeylocust, *Sophora japonica*, flowering crabapple. Brush scales off where practical.
Cankerworms (63, 64), *Alsophila pometaria*, *Paleacrita vernata* (moths)	
Plant abnormalities:	Shredded leaves; inchworms suspended from foliage.
Management options:	There are important egg and larval parasites. Pesticides sprayed to rapidly growing foliage will not provide adequate control. Acephate, *Bacillus thuringiensis* subsp. *kurstaki* and *aizawai,*

Table continues on next page.

Table 2.10.1. Insecticides and acaricides registered for ornamental trees and shrubs *(continued)*

Symbols Used: * = Restricted use pesticide; *[F] = Indicates a federally restricted use pesticide. † = Not for use in Nassau and Suffolk Counties.

Active Ingredient (*Mode of Action Group*)[A] Trade Name(s), Formulation, and Company	EPA Reg. No.	Organic Listed[B]	Use‡	REI§ (hrs.)	PPE *Applicator*	PPE *Early Entry*
Gamma-Cyhalothrin (*3A*) *(continued)*						
Extremely toxic to fish, aquatic invertebrates and toxic to wildlife. Highly toxic to bees. Note New York-specific restrictions about application near wetlands and aquatic sites. Do not apply during temperature invesrsions or when winds exceed 15 mph. Store away from heat and open flame; do not allow to freeze. Not compatible with non-emulsifiable oils, diesel fuel, straight mineral oil, or nutrients containing boron.						
[1]Labeled for conifer and deciduous trees in plantations, nurseries and seed orchards. [2]Labeled for use in residential and non-residential landscapes such as around institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields.						
Geraniol, Citronellol, Nerolidol, Farnesol (*NA*)						
Biomite (1.418%, UPL)	70506-610	OMRI	N, L	4	cefh	cfhk
Miticide for nursery and landscape ornamentals and some other crops. Do not mix with surfactants. Storage temperature should not exceed 104°F.						
Hexythiazox (*10A*)						
*Hexygon IQ (1E, Gowan)[3]	10163-365	–	N, L	12	acf	cfk
Savey 50DF (Gowan)[1]	10163-250	–	N	12	abc	bck
Hexamite (1EC, Albaugh)[1,2]	42750-311	–	N	12	acf	bck
*Hexcel (50DF, Atticus)	91234-40	–	N, L	12	abc	acf
*Hexamite 1AQ (1EC, Prime Source)	89442-59	–	N, L	12	acf	cef
Navaro 1EC (Loveland)[1,2]	34704-1164	–	N	12	acf	cfk
Onager Optek (1E, Gowan)[1,2]	10163-337	–	N	12	acf	cef
Toxic to fish and aquatic invertebrates. Miticide, ovicidal. Incompatible with some EC formulations such as *Diazinon AG500 or 4E and Tempo 2EC. Do not mix with Plyac or household detergents. Apply before adult mite buildup when there are one to three mites per leaf. Adult mites may not be quickly killed, but eggs and immature mites are affected. Long residual activity. Eriophyids such as rust mites are not susceptible. No more than one application per crop cycle is suggested to minimize development of resistant populations.						
[1]Labeled for Christmas trees only. [2]Do not store near heat or open flame. [3]2(ee) label includes use as dip for ornamental plants (bulbs and cuttings) in nurseries, greenhouses, and shadehouses.						
Horticultural Oils – Multiple Types (*non-specific mode of action*)						
Horticultural Oil (98.8%, Lesco)[1]	10404-66	NOP	L	NA		
Horticultural Oil Plus (98.8%, Lesco)[1]	10404-121	NOP	N. L	4	acf	cfk
SunSpray Ultra-Fine Spray Oil (98.8%, HollyFrontier)[1,2]	86330-11	NOP	N, L	4	acf	cfk
Omni Supreme Spray (98%, Helena)[1,2]	5905-368	NOP	N, L	12	acf	cfk
Damoil (98%, Drexel)[2]	19713-123	NOP	N, L	4	acf	cfk
Purespray Spray Oil 10E (98%, Intelligro)[1]	69526-5	NOP	N, L	4	See label	cfk
Ultra-Pure Oil (98%, BASF)	69526-5-499	NOP	N, L	4	acf	cfk
Purespray Green Horticultural Spray Oil (98%, Intelligro)[1]	69526-9	NOP, OMRI	N, L	4	acf	cfk
Purespray 15E (98%, Intelligro)	69526-8	NOP	N[3], L	4	ac	cfk
Purespray Foliar 22E (98%, Intelligro)	69526-7	NOP	N[3], L	4	ac	cfk
Omni Oil 6E (98%, Helena)[1,2,5]	5905-368	NOP	N, L	12	acf	cfk
SuffOil-X (80%, BioWorks)[1]	48813-1-68539	NOP, OMRI	N, L	4	acf	cfk
TriTek (80%, Brandt)[1]	48813-1	NOP, OMRI	N, L	4	acf	cfk
Golden Pest Spray Oil (93%, Stoller Enterprises)[1,2,7]	57538-11	OMRI	N, L	4	See label	See label
RTSA Horticultural Oil (98.8%, Rainbow Treecare)[1,3]	74779-9	NOP	N[3], L	4	acf	cdf
Pycana (89%, OHP)[6]	67702-53-59807	–	N	12	abc	cfk
ClearGuard Horticultural Spray Oil (99%, BVA)[1]	55206-7	NOP	N, L	12	acf	cfk
Petroleum derived paraffinic (most), soybean (Golden Pest Spray), or canola oil (Pycana). Do not apply with sulfur or within 30 days of a sulfur application. Avoid spraying plants suffering from drought stress or winter injury or during periods of high temperature and relative humidity. Do not tank mix with listed fungicides, insecticides, and herbicides and certain other materials such as NPK foliar fertilizers (see. labels). Dwarf Alberta spruce may be sensitive; see labels for other sensitive species. Removes glaucous bloom (blue color) from certain conifers. Do not exceed label rates or apply more often than recommended. Keep spray agitated frequently during application. Toxic to fish						

Table continues on next page.

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. 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 cobblestones, 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 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 dieases 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.

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.

Plant and Disease[1]	Control
Malus **(apples, flowering crab)**	
For home orchard guidelines, see other publications. The following crabapples have been evaluated through a program of yearly assessment for disease incidence at sites throughout the eastern half of the United States: 'Adams', 'Jackii', 'Baskatong', 'Centurion', 'Dolgo', 'Donald Wyman', 'Harvest Gold', 'Henry Kohankie', 'Indian Summer', 'Liset', 'Ormiston Roy', 'Prof Springer', 'Red Jewel', 'Robinson', 'Sentinel', and 'Sugar Tyme'. For additional information on disease resistant crab apples, see https://hdl.handle.net/1813/56373.2.	
Powdery mildew caused by *Podosphaera leucotricha* (Plate ***4, 5***)	Apply propiconazole, triadimefon, copper sulfate pentahydrate, myclobutanil, thiophanate-methyl, *Pageant Intrinsic‡, *Spectro 90 WDG‡, trifloxystrobin, neem oil, or potassium bicarbonate at two-week intervals when mildew first appears on twigs or foliage.
Fire blight caused by *Erwinia amylovora* (Plates 76, 77, ***187***)	Avoid overfertilization, especially heavy spring applications of nitrogen. Cut out cankers and blighted branches in mid-January when tree is dry, making cuts at least 1 ft. below the visible limits of infection. Cover wounds with shellac or other wound dressing. Disinfect tools between cuts. Remove worthless pear, apple, quince, and similar plants from the vicinity. Where disease has just begun to appear, apply copper sulfate pentahydrate, copper hydroxide or use an appropriate formulation of one of the mono-and di-potassium salts of phosphorous acid for the site, or inject Tree Tech OTC‡ per label directions.
Rust caused by *Gymnosporangium* spp. (Plates 118, 119, ***129-133***)	Eliminate nearby red cedar and common juniper to whatever extent practical. Spray with myclobutanil, triadimefon, thiophanate-methyl, chlorothalonil, trifloxystrobin, propiconazole, (or inject *Shepherd Fungicide‡), *Spectro 90 WDG‡, *Pageant Intrinsic‡, or mancozeb. Make three applications at 7- to 14-day intervals or per label directions beginning when orange rust masses develop on junipers (around mid-May).
Scab caused by *Venturia inaequalis* (Plate 95, ***42***)	Spray propiconazole (or inject *Alamo‡, or *Shepherd Fungicide), myclobutanil, copper sulfate pentahydrate, mancozeb, trifloxystrobin, thiophanate-methyl, chlorothalonil, potassium bicarbonate, neem oil, *Pageant Intrinsic‡, or *Spectro 90 WDG‡ per label directions or use an appropriate formulation of one of the mono-and di-potassium salts of phosphorous acid for the site.
Pachysandra **(pachysandra, spurge)**	
Blight caused by *Volutella pachysandricola*	Plants grown in full sun are most likely to become diseased. Those in full shade usually remain healthy. Where plants are already established and disease has become intolerable, rogue and destroy diseased plants. Spray copper sulfate pentahydrate, copper hydroxide, elemental copper (with lime), mancozeb, chlorothalonil, or *Spectro 90 WDG‡ two or three times at 10-day intervals beginning when new growth starts.
Parthenocissus **(Boston ivy, Virginia creeper, woodbine)**	
Leaf spot caused by *Guignardia bidwellii* (Plate 35)	Handpick and destroy infected leaves where possible. Sprays are seldom necessary.
Picea **(spruce)**	
Canker caused by *Leucostoma kunzei* (Plate 93, ***83***)	Keep trees lightly fertilized and watered and avoid all wounds. Remove and destroy all diseased parts, disinfecting tools between cuts. Do not prune in wet weather. *Fungisol w/debacarb‡, micro-injections may be used in landscape situations.
Needlecast caused by *Rhizosphaera kalkhoffii* (Plate 16, ***27***)	This disease is rarely severe enough to warrant control measures. In Christmas tree plantations where damage has become intolerable, use *Protect DF‡, or chlorothalonil, *Spectro 90 WDG‡, or copper hydroxide per label directions.
Twig blight caused by *Sirococcus* sp. (Plate 2, ***58***)	Rogue and destroy heavily infected trees. Spray chlorothalonil, *Spectro 90 WDG‡, *Mural‡, or azoxystrobin before new shoot growth is ½ inch long and spray twice thereafter at three- to four-week intervals.

Table 3.5.1. Some fungicides, bactericides, and nematicides registered for use on trees and shrubs in New York State *(continued)*

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

Example Trade Names, Formulation (Company)	EPA Reg. No.	Use ‡	REI§
Active Ingredient (*Mode of Action Group*)			
Thiophanate-Methyl (*1*)			
*ArmorTech TM 462 (NuFarm)	228-626	N, L	12
*ArmorTech TM 462F (NuFarm)	86064-9	N, L	12
*3336 F (Cleary Chemical)	1001-69	N, L	12
*3336 EG (Cleary Chemical)	1001-89	N, L	12
*T-Methyl SPC 4.5 F (Nufarm)	228-626	N, L	12
*Lesco T-Storm Flowable (Nufarm)	228-626	N, L	12
Broad-spectrum systemic fungicide for control of many leaf diseases and shoot blights. **Note:** Labels vary; some labels contain recommendations for management of pathogens that are not found on other thiophanate-methyl labels. If purchasing a product to treat a specific pest, be certain that product is labeled for that pest.			
Thiophanate-Methyl (*1*) + Iprodione (*2*)			
*ArmorTech TMI 2020 XL (United Turf Alliance)	53883-323-86064	N, L	24
*26/36 Fungicide (Nufarm)	228-630	N, L	24
*Twosome (Lesco)	228-630-10404	N	24
*26/36 Fungicide and *Twosome are labeled for Fusarium on nursery grown boxwood. *Armortech TMI 2020 XL and *26/36 Fungicide not for residential landscape use.			
Triadimefon (*3*)			
Tide Triadimefon 43 SC (Tide)	84229-55	N, L	12
Broad-spectrum fungicide with some systemic activity for control of foliage diseases and some rusts. Product is also labeled for specific diseases on Christmas trees (excluding concolor fir).			
Trichoderma (*T. harzianum* var. Rifai and/or *T. virens*) (*NC*)			
Rootshield Granules (BioWorks)	68539-3	N, L	4
Rootshield WP Biological Fungicide (BioWorks)	68539-7	N	4
Rootshield Plus WP (BioWorks)	68539-9	N. L	4
Rootshield Plus Granules (BioWorks)	68539-10	N	4
Biological fungicide for use in nursery planting mix, when transplanting ornamentals, or as a nursery soil drench to protect plants from roots pathogens such as *Cylindrocladium, Fusarium, Pythium, Rhizoctonia,* and *Thielaviopsis*. See labels for detailed description of REI requirements.			
Trifloxystrobin (*11*)			
Compass Fungicide (Bayer)	432-1371	N, L	12
Trifloxystrobin acts mainly as a preventive fungicide. **Warning:** Trifloxystrobin is of the strobilurin chemical class. To discourage development of resistant pests, alternate sprays with another product with a different mode of action between every one or two treatments, as directed on the label.			

NOTES: W or WP = wettable powder; E or EC = emulsifiable concentrate; F, FL, Flo = flowable, LF = liquid flowable; DF = dry flowable; DG or WDG = water-dispersible granules; WSP or WSB = water-soluble packet or bag; G = granular; S = soluble; AS = aqueous suspension, T/O or T&O = turf and ornamental.

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 wild flower 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.

Fusilade II, Ornamec

Common Name: fluazifop-P-butyl
Formulations: 2EC, 0.5EC

Uses: Selective postemergence control of annual and perennial grasses. May be applied as an over the top or directed spray in many ornamentals including many woody and herbaceous ornamentals in container and field nurseries and landscapes.

	Amount of active ingredient	***Amount by formulation***	
		2EC	0.5EC
Per Acre	0.25 to 0.4 lb.	1 to 1.5 pt.	4 to 6 pt.
Per 1,000 sq. ft.		0.4 to 0.6 fl oz.	1.5 to 2.2 fl. oz.
Spot Treatment (spray solution) (add nonionic surfactant per label directions)		0.75 fl. oz./gal. water	2.5 fl. oz./gal. water

Major Weeds Controlled: Annual and most perennial grasses.

Major Weeds Not Controlled: All broadleaf weeds, sedges, rushes, lilies, and other nongrasses. Bluegrass, red fescue, and sweet vernal grass have shown considerable tolerance.

For Best Results: Mix with nonionic surfactant. Some ready-to-use formulations are available; do not add additional surfactant to such formulations. Spray annual grasses at 2 to 8 inches tall before tillering. For perennial grass, spray during the spring growth flush. Cultivation two to three weeks before or after treatment may assist weed control. Thorough coverage is essential for optimal results; spray to cover but not to runoff.

Cautions and Precautions: Use only a nonionic surfactant on ornamentals. Do not apply if rainfall is expected within one hour. Do not tank mix with other pesticides or fertilizers except as instructed on the label. Do not apply to ornamentals that may be harvested for food within one year. Naturally occurring resistant biotypes of some species are known to exist. If resistance is suspected, additional treatments with this or other herbicides with similar mode of action are not recommended.

Residual Activity: There is little if any reliable soil residual activity.

Volatility and Leaching Potential: Low volatility and negligible leaching when used as directed.

Symptoms and Mode of Action: Growth inhibition occurs within 48 hours. Meristems turn black shortly thereafter. Yellow to red foliage develops in about 7 to 10 days, leading to death within about 14 days. Inhibits cell division by blocking acetyl Co A carboxylase, an enzyme involved in lipid biosynthesis.

Manufacturers: Syngenta
PBI/Gordon Corp.

EPA Reg. Nos.: Fusilade II 2EC: 100-1084
Ornamec 170: 2217-751
Ornamec OTT 0.5EC: 2217-728

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.

Genus, species	Common name	*Barricade	Biathlon	*BroadStar/*SureGuard	Casoron	Devrinol	*Dimension	Fuerte	Goal 2XL	*Kerb	*† Marengo/*† Specticle	OH2	Pendulum	*† Pennant Magnum	Princep	*Ronstar	Surflan	Treflan	XL
Broadleaves *(continued)*																			
Euphorbia hirta	spurge, garden					ful		ful			ful	ful			ful				
Euphorbia maculata	spurge, spotted		ful	ful		ful		ful		ful	ful	ful				par		par	
Euphorbia spp.	spurge						ful					ful							
Euphorbia supina	spurge, prostrate	ful						ful			ful	ful			ful				
Galinsoga ciliata	galinsoga, hairy			ful			ful						ful		par				
Gallium aparine	bedstraw, catchweed							ful											
Gnaphalium falcatum	cudweed, narrowleaf																		
Gnaphalium spp.	cudweed		ful							ful	ful	ful							
Helianthus tuberosus	artichoke, Jerusalem																		
Hypochoeris radicata	catsear, spotted														ful				
Ipomea hederacea	morningglory, ivyleaf			ful			ful	par											
Ipomea purpurea	morningglory, tall			ful			ful	par											
Ipomea spp.	morningglory, annual						ful		ful					ful		par		par	
Kochia scoparia	kochia	ful		ful			ful			ful		ful					ful		
Lactuca serriola	lettuce, prickly				ful			ful						ful		par		par	
Lamium amplexicaule	henbit	ful		ful		ful	ful	ful	ful	ful		ful		ful		ful		ful	
Lamium purpureum	deadnettle																		
Lepidium perfoliatum	pepperweed, yellowflower							ful						ful					
Lepidium virginicum	pepperweed, Virginia		ful							ful	ful			ful					
Malva spp.	mallow			ful			ful	ful	ful						ful	par		par	
Marchantia spp.	liverwort			ful			par								par				
Matricaria matricarioides	pineappleweed			ful	ful	ful	ful							ful					
Medicago hispita	burclover			ful			ful	ful						ful					
Medicago lupulina	medic, black					ful				par									
Mollugo verticillata	carpetweed	ful		ful	ful	ful	ful	ful	ful			ful	ful	ful	ful	ful	par	ful	
Montia perfoliata	lettuce, miners																		
Moss (several genera)	moss			ful			ful												
Oenothera laciniata	eveningprimrose, cutleaf									ful					par				
Oenothera spp.	eveningprimrose									ful		ful			par				
Oxalis corniculata	woodsorrel, creeping					ful	ful												
Oxalis stricta	woodsorrel, yellow	ful	ful	ful		ful	ful	ful		par	ful	ful			ful	ful		ful	
Physalis spp.	groundcherry							ful											
Plantago spp.	plantain species			ful			ful			ful									
Polygonum aviculare	knotweed, prostrate	ful			ful	ful		ful	ful	ful		ful				ful	ful	ful	
Polygonum convolvulus	buckwheat, wild							ful		ful									
Polygonum pensylvanicum	smartweed, Penn.			ful				ful				ful		ful	ful	par		par	
Polygonum persicaria	ladysthumb/smartweed			ful			ful	ful								par		par	
Portulaca oleracea	purslane, common	ful		ful	ful	ful	ful	ful	ful	ful		ful	par	ful	ful	ful	ful	ful	
Raphanus raphanistrum	radish, wild																		
Richardia scabra	pusley, Florida	ful		ful								ful	ful	ful		ful	par	ful	
Rumex acetosella	sorrel, red							ful	par										
Rumex crispus	dock, curly									ful									
Sagina procumbens	pearlwort, birdeye		ful	ful			ful				ful								
Salsola kali	thistle, Russian			ful	ful				ful						ful			ful	

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 f = field
* Restricted use pesticide *[F] Federally restricted use pesticide † = Not for use in Nassau or Suffolk Counties

			Ornamental species registered								
Application Type	**Long Island Use?**	**Trade Name**	*Shade Trees*	*Narrow Leaf (Needle) Evergreens*	*Broadleaf Evergreens*	*Deciduous Shrubs*	*Groundcovers (Woody &Semi-Woody)*	*Perennials (Herbaceous)*	*Ornamental Grasses*	*Bulbs*	*Annuals (Bedding Plants)*
pre	no	*†Pennant Magnum	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Few (f/c)	Few (f)	Several (f)
pre	yes	*Ronstar (G)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Few (f/c)	Few (f/c)	None	None
post directed	yes	Roundup Pro	Several (f)	Several (f)	Several (f)	Several (f)	None	None	None	None	None
post directed	yes	Scythe	Several (f)	Several (f)	Several (f)	Several (f)	Several (f)	Several (f)	Several (f)	Several (f)	Several (f)
post directed	yes	Sedgehammer +	Several (f)	Several (f)	Several (f)	Several (f)	Several (f)	None	None	None	None
pre	yes/no	*Simazine (several)	Several (f)	Several (f)	Several (f)	Few (f)	None	None	None	None	None
pre	yes	*Sureguard	Several (f/c)	Several (f/c)	None	None	None	None	None	None	None
pre	yes	Surflan	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Few (f/c)	Several (f/c)	Several (f/c)
pre	yes	Treflan	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)
pre	yes	XL 2G (Surflan XL)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	None	Several (f/c)	Several (f/c)

Table 4.10.2. Herbicides registered <u>for landscape use</u> in New York State

Trade Name	**Common Name**	**Spray or Granular**	**Pre or Post**	**Plant Types that may be found on the Label ***Check Label for Species***					**Weeds Controlled**	**Application**	**Post-Plant Interval**	**Residential landscape restrictions[3]**
				Turf	**Annuals**	**Perennials**	**Trees & Shrubs**	**Orn. Grasses**				
Acclaim Extra	fenoxaprop	S	post	✓	✓	✓	✓		ann grasses	OT	Established	
*Barricade 4L	prodiamine	S	pre	✓	✓	✓	✓	✓	ann grass & bl weeds	OT	Newly planted (after soil settles)	
*Barricade 65WG	prodiamine	S	pre	✓	✓	✓	✓	✓	ann grass & bl weeds	OT	Newly planted (after soil settles)	
Barrier	dichlobenil	G	pre	can injure turf			✓		ann & per grass & bl weeds	D	Established	
BasagranT&O	bentazon	S	post	✓	✓	✓	✓	✓	bl weeds & sedges	D or OT	Label does not specify	
Biobarrier [1]	trifluralin	Geo-textile	pre	✓	✓	✓	✓	✓	roots	Under surface	None	
*BroadStar	flumioxazin	G	pre				✓		ann grass & bl weeds	OT	Established	

Table 4.10.3. Selected Approved Uses in NYS Under FIFRA Section 2(ee) Recommendations

Always review and follow label directions, restrictions, and precautions. The FIFRA 2(ee) label must be in the possession of the user at the time of application. Permits and possession of other publications may be required as well; see 2(ee) label for all requirements. See Section 1.10 for more information.

Trade Name	EPA Reg. No.	Target	Site(s)	Comments
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Flowering Rush	All labeled sites	Surface water application restricted
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Oriental Photinia	All labeled sites	Surface water application restricted
*Roundup Custom for Aquatic & Terrestrial Use	524-343	False spiraea and Japanese spiraea	All labeled sites	Apply as foliar or fresh cut stump treatment.
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Japanese Stiltgrass (*Microstegium vimineum*)	All labeled sites	Apply 0.25 to 2% solution as a spray-to-wet application.
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Japanese Angelica tree	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Castor Aralia	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Tree of Heaven	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Amur Cork Tree	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Black Jetbead	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Burning Bush, J. Barberry, Porcelain Berry, Yellow Iris	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Cup Plant	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Hardy Kiwi	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Japanese Tree Lilac	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Kiwifruit & Silver Vine	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Lesser Celandine	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Sapphire Berry	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Sticky Sage	All labeled sites	
*Roundup Custom for Aquatic & Terrestrial Use	524-343	Viburnum	All labeled sites	

Table 4.11.1. Cross-reference for ornamental scientific names

Common name	Genus, species
pine, loblolly	*Pinus taeda*
pine, longleaf	*Pinus palustris*
pine, mugo	*Pinus mugo*
pine, red	*Pinus resinosa*
pine, Scotch	*Pinus sylvestris*
pine, scrub	*Pinus virginiana*
pine, white	*Pinus strobus*
planetree, London	*Platanus acerifolia*
plum, cherry	*Prunus cerasifera*
podocarpus species	*Podocarpus spp.*
poplar species	*Populus spp.*
potentilla, bush	*Potentilla fructiosa*
privet species	*Ligustrum spp.*
privet, California	*Ligustrum ovalifolium*
privet, Chinese	*Ligustrum sinense*
privet, glossy	*Ligustrum lucidum*
privet, Japanese	*Ligustrum japonicum*
quince, flowering	*Chaenomeles speciosa*
redbud, eastern	*Cercis canadensis*
rhododendron species	*Rhododendron spp.*
rhododendron, great laurel	*Rhododendron maximum*
rhododendron, rosebay	*Rhododendron catawbiense*
rose of sharon	*Hibiscus spp.*
rose species	*Rosa spp.*
Russian olive	*Elaeagnus angustifolia*
smokebush	*Cotinus coggygrria*
sourwood	*Oxydendrum arboreum*
spirea species	*Spiraea spp.*
spirea, Vanhoutte	*Spiraea vanhouttei*
spruce species	*Picea spp.*
spruce, blue	*Picea pungens*
spruce, Norway	*Picea abies*
spruce, white	*Picea glauca*
sweetgum, American	*Liquidambar styraciflua*
sycamore	*Platanus occidentalis*
tulip tree	*Liriodendron tulipifera*
viburnum species	*Viburnum spp.*
viburnum, Am. cranberry	*Viburnum trilobum*
viburnum, Eur. cranberry	*Viburnum opulus*
viburnum, Judd	*Viburnum juddii*
viburnum, Korean spice	*Viburnum carlesii*
viburnum, shasta	*Viburnum plicatum*
walnut species	*Juglans spp.*
walnut, black	*Juglans nigra*
weigela species	*Weigela spp.*
weigela, oldfashioned	*Weigela florida*
willow species	*Salix spp.*
witch hazel	*Hamamelis virginiana*
yew species	*Taxus spp.*
yew, Anglojapanese	*Taxus x media*
yew, Canada	*Taxus canadensis*
yew, Japanese	*Taxus cuspidata*

Table 4.11.2. Cross-reference for weed scientific names

"Where" column indicates where to find weeds on Tables 4.9.1 and 4.9.2: B=Broadleaves Section, G=Grasses & Sedges Section

Common name	Genus, species	Where
anoda, spurred	*Anoda cristata*	B
artichoke, Jerusalem	*Helianthus tuberosus*	B
aster	*Aster* spp.	B
barley, foxtail	*Hordeum jubatum*	G
barley, little	*Hordeum pusillum*	G
barley, volunteer	*Hordeum vulgare*	G
barley, wild/hare	*Hordeum leporinum*	G
barnyardgrass	*Echinchloa crus-galli*	G
bedstraw, catchweed	*Gallium aparine*	B
beggarticks	*Bidens* spp.	B
bentgrass, colonial	*Argostis tenuis*	G
bermudagrass	*Cynodon dactylon*	G
bindweed	*Convolvulus* spp.	B
bittercress	*Cardamine* spp.	B
blackberry	*Rubus* spp.	B
bluegrass, annual	*Poa annua*	G
bluegrass, bulbous	*Poa bulbosa*	G
bluegrass, Kentucky	*Poa pratensis*	G
briar, green/cat	*Smilax* spp.	B
brome, cheat	*Bromus secalinus*	G
brome, downy	*Bromus tectorum*	G
brome, ripgut	*Bromus rigidus*	G
brome, soft	*Bromus mollis*	G
broomsedge	*Adropogon virginicus*	G
buckwheat, wild	*Polygonum convolvulus*	B
burclover	*Medicago hispita*	B
burdock, common	*Arctium minus*	B
buttercup	*Rannunculus* spp.	B
buttonweed	*Borreria laevis*	B
canarygrass	*Phalaris canariensis*	G
carpetweed	*Mollugo verticillata*	B
carrot, wild	*Daucus carota*	B
catsear, spotted	*Hypochoeris radicata*	B
chamomile, mayweed	*Anthemis cotula*	B
chickweed, common	*Stellaria media*	B
chickweed, mouseear	*Cerastium vulgatum*	B
citronmelon	*Citrullus lanatus*	B
clematis	*Clematis* spp.	B
clover, hop	*Trifolium procumbens*	B
clover, red	*Trifolium pratense*	B
clover, white	*Trifolium repens*	B
cocklebur, common	*Xanthium strumarium*	B
copperleaf, Virginia	*Acalypha virginica*	B
corn, volunteer	*Zea mays*	G
crabgrass, hairy/large	*Digitaria sanguinalis*	G
crabgrass, smooth	*Digitaria ischaemum*	G
cudweed	*Gnaphalium* spp.	B
cudweed, narrowleaf	*Gnaphalium falcatum*	B
dandelion	*Taraxicum officianale*	B
dayflower	*Commelina* spp.	B
deadnettle	*Lamium purpureum*	B
dock, curly	*Rumex crispus*	B

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 disking 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.

Tips for Laundering Pesticide-Contaminated Clothing

Pre-Laundering Information

Remove contaminated clothing **before** entering enclosed tractor cabs.

Remove contaminated clothing **outdoors** or in an entry. If a granular pesticide was used, shake clothing outdoors. **Empty pockets and cuffs.**

Save clothing worn while handling pesticides for that use only. Keep separate from other clothing **before, during, and after** laundering.

Wash contaminated clothing after **each** use. When applying pesticides daily, wash clothing **daily**.

Clean gloves, aprons, boots, rigid hats, respirators, and eyewear by scrubbing with detergent and warm water. Rinse thoroughly and hang in a clean area to dry.

Take these **precautions** when handling contaminated clothing:

- Ventilate area.
- Avoid inhaling steam from washer or dryer.
- Wash hands thoroughly.
- Consider wearing chemical-resistant gloves.
- Keep out of reach of children and pets.

Air

Hang garments outdoors to air.

Pre-rinse

Use one of three methods:

1. Hose off garments outdoors.
2. Rinse in separate tub or pail.
3. Rinse in automatic washer at full water level.

Pretreat (heavily soiled garments)

Use heavy-duty liquid detergent.

Washer Load

Wash garments separate from family wash.

Wash garments contaminated with the same pesticide together.

Never use the “sudsaver” feature on your machine when laundering pesticide-soiled clothes.

Load Size

Wash only a few garments at once.

Water Level

Use full water level.

Water Temperature

Use **hot** water, as hot as possible.

Wash Cycle

Use **regular** wash cycle, at least 12-minutes.

Laundry Detergent

Use a **heavy-duty** detergent.

Use amount recommended on package or more for heavy soil or hard water.

Remember to use high-efficiency (HE) detergents in HE and front-loading washers.

Rinse

Use a **full** warm rinse.

Rewash

Rewash contaminated garments **two or three times** before reuse for more complete pesticide removal.

Dry

Line drying is preferable to avoid contaminating dryer.

Clean Washer

Run complete, but empty, cycle.
Use **hot water and detergent.**

Prepared by Charlotte Coffman, College of Human Ecology, Department of Fiber Science and Apparel Design, Cornell University

PESTICIDE EMERGENCY NUMBERS

Poison Control Centers

Poison Control Centers nationwide 800-222-1222

Emergency responder information on pesticide spills and accidents…

CHEMTREC 800-424-9300

For pesticide information…

National Pesticide Information Center 800-858-7378

To Report Oil and Hazardous Material Spills in New York State…

NYS Spill Hotline 800-457-7362

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