2021
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.

2021 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; may be purchased and used only by certified applicators
† ..... Not for use in Nassau and Suffolk Counties
Δ..... 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 (May 2021). Changes in pesticide registrations, regulations, and guidelines occurring after publication are available in county Cornell Cooperative Extension offices or from the Pesticide Management Education Program web site (pmep.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.

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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

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 Pesticide Management Education Program (PMEP) at Cornell University (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 you begin to use 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 is the minimum that must be worn during the pesticide's use. Pesticide users can always wear more protection than the label requires.

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 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 *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-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

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

Plant	Pest	Page No.	Plate No.
Willow *(continued)*	oystershell scale	370	**177**
	poplar-and-willow borer	268	**126**
	willow flea weevil	190	**87**
	willow twig aphid	228	**106**

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)

Host	Pest	Stage	GDD (Base 50°F)
Dormant Season (usually March or early April): No plant phenological markers offered for dormant season.			
Arborvitae	Fletcher scale	immature	20–60
	spruce spider mite	egg	7–121
Azalea	azalea bark scale	adult	Not Available
Bittersweet	euonymus scale	adult	35–70
Crabapple	European red mite	egg	7–58
Deciduous plants	aphids	egg	7–100
Douglas-fir	Cooley spruce gall adelgid	immature	22–91
Elm	elm bark beetle	larva	7–120
	European elm scale	nymph	7–120
	European red mite	egg	7–58
	lecanium scales	adult	35–110
Euonymus	euonymus scale	adult	35–70
Flowering fruit trees	lecanium scales	adult	35–110
Hemlock	elongate hemlock scale	adult	7–120
	hemlock rust mite	immature/adult	7–450
	hemlock scale	adult	35–121
	spruce spider mite	egg	7–121
Holly	southern red mite	egg	7–91
Honeylocust	lecanium scales	adult	35–110
Juniper	juniper scale	adult/egg	22–148
	spruce spider mite	egg	7–121
Lilac	oystershell scale	egg	7–91
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

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.

Arborvitae leafminers (14), *Argyresthia* sp. (moth) *(continued)*

Management options:	Many effective larval and pupal parasites. Soil application of systemic insecticides (imidacloprid), foliar sprays to control larvae (acephate##), or moths (bifenthrin, lambda–cyhalothrin, permethrin, spinosad). Trunk injection (emamectin benzoate). [##]2(ee) recommendation of *Acephate 97 UP for use on unlabeled pest. The 2(ee) recommendation must be in the applicator's possession when using *Acephate 97 UP for control of arborvitae leafminer. See 2(ee) at http://www.dec.ny.gov/nyspad/products.
When to treat:	Soil application with imidacloprid to control larvae in early spring. Acephate foliar spray for larvae: mid-May, 150–260 GDD. Again mid-August, 1800–2200 GDD. Treat moth stage: mid-June, 533–700 GDD.
IPM considerations:	Parasites usually not abundant in specimen trees. For sprays, two applications may be required for first year of treatment; one application of spinosad during early moth flight has provided good control in one trial. If infestation is light, prune out infested tips.

Azalea bark scale (160), *Eriococcus azaleae* (felt scale)

Plant abnormalities:	Honeydew and sooty mold, yellowing leaves and dieback.
Management options:	One important chalcid wasp parasite. Acephate, acetamiprid (8.5SL, trunk spray or injection), carbaryl, cyfluthrin, horticultural oil, insecticidal soap, lambda-cyhalothrin, malathion, pyriproxyfen [Distance, 2(ee)[##], Defiance)], spirotetramat (Kontos spray, container drench). [##]2(ee) recommendation for use on unlabeled pest. The 2(ee) recommendation must be in the applicator's possession when using Distance for control of azalea bark scale. See 2(ee) at http://www.dec.ny.gov/nyspad/products.
When to treat:	Delayed dormant (oil). Again late June to late July, PPI-*Tilia cordata*, *Abelia*. Application targeting crawlers mid-July (1424 GDD) was highly effective.
IPM considerations:	Crawlers tend to settle in twig crotches, bark crevices, and axils of leaves. Thoroughly wet bark from all sides when treating. Hosts include azalea, rhododendron, and andromeda.

Azalea leafminer (93), *Caloptilia azaleella* (moth)

Plant abnormalities:	Brown blotch leaf mines and leaves tied together with silk.
Management options:	Pesticides used mostly to control larvae. Parasites not capable of reducing populations to an acceptable level. Abamectin, carbaryl, cyantraniliprole, cyclaniliprole, dimethoate, imidacloprid (soil application), permethrin.
When to treat:	June, 450–800 GDD, PPI-Kousa dogwood, beautybush. Again in late July for second generation, 1260–1500 GDD, PPI-Abelia, sourwood. Imidacloprid soil application in spring.
IPM considerations:	Do not apply sprays when in flower. Older larvae feed externally, tying leaves together with silk. Rake and destroy fallen leaves.

Azalea lace bug (204), *Stephanitis pyrioides* see Lace bugs

Azalea whitefly (151), *Pealius azaleae*

Plant abnormalities:	Honeydew and sooty mold, discolored foliage, yellowish mottle.
Management options:	Large populations may require use of pesticides. Bifenthrin, cyantraniliprole, cyclaniliprole, cyfluthrin, diazinon, dimethoate, flonicamid, flupyradifurone (foliar spray or container drench), fluvalinate, horticultural oil, imidacloprid (soil, foliar), lambda-cyhalothrin, malathion, neem oil, spirotetramat (Kontos).
When to treat:	Sprays as needed early to mid-June, 448–700 GDD, PPI-mt. laurel, *Philadelphus*, again mid-July to early August, 1250–1500 GDD, and September, 2032–2150 GDD. Imidacloprid soil application in early spring.
IPM considerations:	Limited information on biology in the US. Whitefly feeds on undersurface of leaves on azalea ('Delaware Valley White' and related hairy leaved hybrids), rhododendron, mt. laurel, and andromeda. Most insecticides control both adults and immatures. Resistant azalea varieties are available.

Table 2.10.1. Insecticides and acaricides registered for ornamental trees and shrubs

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*
Pyriproxyfen (*7C*)						
Distance (0.86EC, Valent)	59639-96	–	N, L	12	cdfgij	dfgj
Fulcrum (0.86EC, OHP)	59807-14	–	N, L	12	defgij	defgj
Defiance 0.86EC (Atticus)	91234-58	–	N, L	12	adfgij	dfgj
Proxite (0.86EC, Rainbow)	59639-96-74779	–	L	NA	cdfgij	
Insect growth regulator for certain scale insects (crawlers) and other pests. Has translaminar and ovicidal activity. Distance and Proxite labels include language allowing use against a broad range of scale insects. Applicators must have a copy of the 2(ee) in their possession when using for these pests. Toxic to fish and aquatic invertebrates. Note plant sensitivity cautions (not for use on *Salvia*, *Heuchera*, several others). Store cool and dry.						
Sodium Ferric EDTA						
IronFist Slug and Snail Bait (2%P, Belchim)	67702-32-87865	–	N, L	0	ac	–
Ferroxx (5%, Neudorff)	67702-33	–	N, L	0	ac	–
Biopesticide pelletized bait labeled for outdoor ornamentals and greenhouse use. Can be applied in pots of container-grown nursery plants. Do not apply bait directly to soft-leaved plants or directly to water. Bait should be scattered and not placed in piles.						
Spinosad (*5*)						
Conserve 1SC (Corteva)[1,2]	62719-291	–	N, L	4	ac	cfk
Entrust SC (Corteva)[2]	62719-621	OMRI	N	4	ac	cfk
[1]Effective on many caterpillars (particularly smaller stages), thrips, and some leaf-feeding beetles. Also labeled for dipterous leafminers (such as holly and serpentine). For use in landscapes, nurseries and greenhouses. [2]Labeled for control of various caterpillars for tree farms or plantations, conifers (including Christmas trees), and deciduous trees.						
Spirotetramat (*23*)						
Kontos (2SC, Bayer)	432-1471	–	N	24	acfh	acfh
Movento (2SC, Bayer)[1]	264-1050	–	N	24	acf	acf
Insecticide and (as drench only) miticide; Kontos includes soil application uses for container-grown plants. Systemic activity both upward and downward in treated plants; efficacy may be hindered during periods of cold temperatures, under drought conditions, or when plants are not actively growing. Efficacy of foliar sprays may be improved with added penetrating surfactant, where allowed, and timed for tender new growth present. Primarily active through ingestion. Do not make more than one application per season to hydrangea; note other sensitive plants on label. [1]For use in Christmas tree plantations; must be tank-mixed with a spreading/penetrating adjuvant.						
Tebufenozide (*18*)						
*†Confirm 2F (Gowan)	8033-111-10163	–	N	4	abc	bgk
Not for sale, distribution, or use in Nassau and Suffolk Counties. Insect growth regulator (disrupts molting) for certain caterpillar pests. Reduced-risk insecticide. Mainly ingestion with some contact activity but minimal impact on natural enemies. Labeled for use in Christmas trees for control of gypsy moth, certain tussock moths, spruce budworm, pine tip moths and a variety of other caterpillar pests. Toxic to aquatic invertebrates; note additional New York label restrictions regarding application near aquatic areas. Store cool and dry above 32°F.						
Thiamethoxam (4A)						
*†Flagship 25WG (Syngenta)	100-955	–	N	12/24	acf	cfk
Not for sale, distribution, or use in Nassau and Suffolk Counties. In New York State, use is limited to Christmas trees and indoor greenhouse. For foliar and soil use. Avoid use with adjuvants that bind material to leaf surface. (Other wetting agents are permitted.) Toxic to wildlife and highly toxic to aquatic invertebrates. This product is highly toxic to bees exposed to direct treatment. **Note pollinator protection restrictions.** Among container-grown ornamentals and ornamentals grown in planting or liner beds, some plant species may be sensitive to fertilizers. Do not tank mix with fertilizers for treatment of these plants grown under these conditions. Do not use on yellow honeylocust varieties.						
Trichlorfon (*1B*)						
Dylox 420SL T&O (Bayer)	432-1464	–	L	NA	acf	
Foliar insecticide spray for landscape flowers, shrubs and trees and drench for narcissus bulb fly. Toxic to fish and wildlife; extremely toxic to aquatic invertebrates. Spray drift may damage painted surfaces. Do not apply within 25 feet of lakes, reservoirs, streams, marshes, natural ponds, or estuaries or when winds exceed 15 mph. Maximum one application in a seven-day period. Allow spray to dry before allowing people or pets into treated area. Store in a cool, dry place.						
Z-Tetradec-7-en-2-one						
Oriental Beetle MD (50 mg, AgBio)	68253-1	–	N	NA	abcm	
Pheromone dispensers used for mating disruption to control oriental beetle grub infestation in field and container nurseries. Dispensers must be placed just prior to or at first adult emergence, around the first week of June on Long Island. Mating disruption works by						

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 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 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 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.

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

Scientific Name	Common Name
Berberis	Barberry
Buxus	Boxwood
Carpinus	Hornbeam

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
***Hedera* (English ivy)**	
Leafspot caused by *Xanthomonas hortorum* pv. *hederae* (syn. *X. campestris* pv. *hederae*) (Plate 74, ***185***)	Remove and destroy affected leaves in autumn. Apply fosetyl-Al (for suppression), CuPRO 5000‡, *Agri- Fos, or Camelot O‡ as symptoms appear during the growing season or use an appropriate formulation of one of the mono-and di-potassium salts of phosphorus acid for the site. 'Gold Dust' is resistant. 'Brokamp' and 'Hahn Variegated' are highly susceptible.
***Juglans* (walnut, butternut)**	
Bacterial blight caused by *Xanthomonas arboricola* pv. *juglandis* (syn.=*X.* campestris pv. *juglandis* (Plate 75, ***186***)	Prune and destroy infected shoots if possible, disinfecting tools between cuts. Apply *Junction‡ at prebloom, bloom, and early nutlet stages.
Anthracnose caused by *Gnomonia leptostyla* (conidial state =Marssoniella; syn.=*Marssonina*) (Plate 54, ***51***)	Destroy or compost fallen leaves. Spray with mancozeb, *Junction‡, propiconazole, thiophanate-methyl, chlorothalonil, or *Spectro 90 WDG‡ three times at two-week intervals beginning at budbreak.
***Juniperus* (juniper, red cedar)**	
Rust caused by *Gymnosporangium* sp. (Plate 115, ***129-133***)	Do not plant near hawthorn, flowering crab, quince, or similar plants. Remove galls from plants in spring where practical. Spray severely affected plants with triadimefon, *Armada‡, *Pageant Intrinsic‡, *Mural‡, azoxystrobin, myclobutanil, mancozeb, or *Junction‡ two times at three-week intervals beginning in early August, or follow label directions. Use disease-resistant selections for new plantings.
Blight caused by *Phomopsis juniperovora* (Plate 64, ***72***)	Prune and destroy infected shoots where practical. Avoid overhead irrigation. Rogue and destroy infected plants in young plantings. Spray with mancozeb, propiconazole, copper sulfate pentahydrate, copper hydroxide, *Mural‡, azoxystrobin, *Fungisol w/debacarb‡, thiophanate-methyl, or *Junction‡ at two-week intervals throughout the growing season or per label directions.
Blight caused by *Kabatina juniperi* (Plate 64, ***72***)	Use thiophanate-methyl, Protect DF‡, or *Fungisol w/debacarb‡, to treat according to label directions. In sites with a history of this disease, plant resistant selections.

Disease-Resistant Junipers. Many species of *Juniperus* have been reported to be resistant to at least one of the common diseases. However, because all three are ubiquitous, resistance to at least two of the three is advisable. Listed below are taxa with such resistance.

Species	*Resistant to:*		
Variety	**Phomopsis**	**Kabatina**	**Rusts**
J. chinensis			
Femina	X		X
Hetzii		X	X
Iowa	X		
Keteleeri	X	X	X
Pfitzeriana	X	X	X
Sargentii	X	X	X
sarg.-glauca	X	X	
J. communis			
Depressa	X		X
Hibernica		X	X
Saxatalis	X		X

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

Example Trade Names, Formulation (Company)	EPA Reg. No.	Use ‡	REI§
Active Ingredient (*Mode of Action Group*)			
Myrothecium Verrucaria, Dried Fermentation Solids and Solubles (*NC*)			
DiTera DF (Valent)	73049-67	N	4
Nematicide for pre-plant, planting, and post-plant suppression of labeled nematode species.			
Neem Oil, Clarified Hydrophobic (*NC*)			
Triact 70 (OHP)	70051-2-59807	N, L	4
For control of black spot of rose, powdery and downy mildews, scab, and rust on many plant species. **Note:** 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.			
Oxytetracycline Calcium Complex (*41*)			
*Tree Tech OTC (Florida Silvics)	64014-11	N, L	0
For injection to suppress Bacterial Leaf Scorch (Xylella) in Oak and Vascular Yellows in Ash and Elm and Fire Blight in labeled hosts.			
Potassium Bicarbonate (*NC*)			
Milstop SP (BioWorks)	68539-13	N, L	1
Milstop Broad Spectrum (BioWorks)	70870-1-68539	N, L	1
Kaligreen (Otsuka Agritechno)	11581-2	N	4
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.			
Propamocarb Hydrochloride (*28*)			
Banol Fungicide (Bayer)	432-942	N	24
Banol T&O Fungicide (Bayer)	432-942	N	24
Fungicide for control of *Phytophthora* on woody ornamentals grown in greenhouses or in pots in nurseries. Not for use on field grown ornamentals.			
Propiconazole (*3*)			
*Alamo Fungicide (Syngenta)	100-741	L	NA
Dorado Fungicide (Syngenta)	100-741	N, L	12
*Quali-Pro Propiconazole 14.3 (Control Solutions)	53883-363	N, L	12
*Shepherd Fungicide (ArborSystems)	69117-3	N	NA
Lesco Spectator T&O Fung. (Nufarm)	228-633	N, L	12
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.			
Pyraclostrobin (11) + Boscalid (7)			
*Pageant Intrinsic (BASF)	7969-251	N, L	12
Warning: 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.			
Thiabendazole Hypophosphite (*1*)			
*Arbotect 20-S (Syngenta)	100-892	N, L	0
Systemic fungicides for injection into elms for Dutch Elm Disease, and Sycamore Anthracnose control. Special training in injection techniques required.			
Thiophanate-Methyl (*1*)			
*ArmorTech TM 462 (NuFarm)	228-626	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

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

Biathlon

Common Name: oxyfluorfen + prodiamine
Formulation: 2 + 0.75 G

Uses: Preemergence control of weeds in field and container ornamentals, grounds maintenance and other specified non-crop areas and for evergreen (broadleaf and needle) limited to Christmas tree farms and conifer farms.

	Amount of active ingredient	*Amount by formulation*
		2.75G
Per Acre	2.75 lb.	100 lb.
Per 1,000 sq. ft.		2.3 lb.

Major Weeds Controlled: Grass weeds including annual bluegrass, crabgrass, and goosegrass and broadleaf weeds, including bittercress, pigweed, and chickweed.

Major Weeds Not Controlled: Established weeds.

For Best Results: Apply in early spring or fall prior to weed seed germination or following complete weed removal. Irrigate before application to firm soil around roots. Apply at least 0.5 inch irrigation or rainfall within 24 hours. Apply to dry foliage only and immediately wash the particles off plant foliage. Do not apply while plants are producing new flush of growth.

Cautions and Precautions: Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Runoff from treatment areas may be hazardous to aquatic organisms in neighboring areas. A maximum of two applications may be made in a growing season. Do not reapply at less than three month intervals for field-grown ornamentals and less than two month intervals for Christmas trees. See label for list of plants for which injury has been observed and use is not recommended.

Residual Activity: Creates a barrier in the soil and is active for several months.

Volatility and Leaching Potential: Photodecomposition and volatilization occur when the prodiamine remains on the surface for prolonged periods without incorporation. Prodiamine is strongly adsorbed by soil; not readily leached. Oxyfluorfen is relatively highly water soluble and has moderate leaching potential, greatest in coarse-textured soils with frequent irrigation.

Symptoms and Mode of Action: Inhibits cell division and disrupts cell wall formation in shoots and roots of emerging seedling weeds.

Manufacturer: OHP

EPA Reg. No.: 59807-12

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	*†Dacthal	Devrinol	*ΔDimension	Fuerte	Goal 2XL	*Kerb	*†Marengo/*†Specticle	OH2	Pendulum	*†Pennant Magnum	Princep	*Ronstar	*Rout	Surflan	Treflan	XL
Grasses *(continued)*																					
Hordeum leporinum	barley, wild/hare				ful		ful	ful												ful	
Hordeum pusillum	barley, little							ful											ful		ful
Hordeum vulgare	barley, volunteer							ful			ful										
Leptochloa uninervia	sprangletop, red	ful	ful				ful		ful				ful	ful	ful				ful	ful	ful
Lolium multiflorum	ryegrass, Italian/annual						ful	ful			ful	ful				ful					ful
Lolium perenne	ryegrass, perennial							ful			ful	ful									
Panicum capillare	witchgrass	ful			ful		ful		ful	ful				ful	ful	ful			ful	ful	ful
Panicum dichotomiflorum	panicum, fall	ful	ful	ful			ful		ful		ful			ful	ful	ful	ful	ful	ful	ful	ful
Phalaris canariensis	canarygrass										ful										
Phleum pratense	timothy				ful																
Poa annua	bluegrass, annual	ful	ful	ful	ful	par	ful	ful	ful	par	ful	ful	ful	ful	ful	ful	ful	ful	ful	ful	ful
Poa pratensis	bluegrass, Kentucky				ful						ful										
Setaria faberi	foxtail, giant	ful		ful	ful		ful		ful	par		ful		ful	ful	ful			ful	ful	ful
Setaria italica	millet, foxtail	ful			ful										ful					ful	ful
Setaria lutecens/glauca	foxtail, yellow	ful	ful	ful	ful	ful	ful	ful	ful		ful			ful	ful	ful		ful	ful	ful	ful
Setaria spp.	foxtail species	ful			ful											ful				ful	ful
Setaria vertcilla	foxtail, bristly	ful		ful	ful		ful		ful							ful	ful			ful	ful
Setaria viridis	foxtail, green	ful	ful	ful	ful	ful	ful	ful	ful			ful		ful	ful	ful	ful	ful	ful	ful	ful
Sorghum bicolor	shattercane														par					par	
Sorghum halepense	johnsongrass (rhizome)					no															
Sorghum halepense	johnsongrass (sdlg)	ful				par	ful		ful					ful	par				ful	par	ful
Triticum aestivum	wheat, volunteer										ful								par		par
Vulpia myuros	fescue, rattail				ful											ful				ful	

Table 4.9.2. Weed susceptibilities to POSTemergence herbicides

KEY:
ful = full control is expected.
pa = partial control is expected.
no = no control is expected.

Genus, species	Common name	AcclaimExtra	*Asulox	Basagran	*ΔEnvoy	†Finale	Fusilade II	Goal 2XL	*Gramoxone	*†ΔLontrel	Diquat SPC 2L, *Littora	Roundup Pro	Scythe	SedgeHammer 75WDG	Segment	*SureGuard
Broadleaves		par														
Abutilon theophrasti	velvetleaf	par			no	ful	no	ful	par		par	par	par		no	ful
Acalypha virginica	copperleaf, Virginia	par			no	ful	no		par		par	ful	par		no	
Acer spp.	maple	par			no		no		par		par	ful	par	no	no	
Allium canadense	onion, wild	par			no	ful	no		par		par	ful	par	no	no	
Amaranthus blitoides	pigweed, prostrate	par			no		no	ful	ful		ful	ful	par	no	no	ful
Amaranthus hybridus	pigweed, smooth	par			no		no		ful		ful	ful	par	no	no	ful
Amaranthus retroflexus	pigweed, redroot	par			no	ful	no	ful	ful		ful	par	par	no	no	ful
Amaranthus spinosus	pigweed, spiny	par			no		no		ful		ful	ful	par	no	no	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 † = 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	yes	Pendulum	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	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
pre	yes	*Rout	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Several (f/c)	Few (f/c)	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	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 for landscape use 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	

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.