Pesticide Selection Guide for Insects and Mites Affecting Woody Ornamentals and Herbaceous Perennials in Nebraska

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This publication contains information on pesticides registered for control of the insects and mites affecting woody ornamentals in Nebraska. A companion Web site has been developed to help you identify key pests and their damage, and explain life cycles and management procedures in greater detail. The Woody Ornamental Web site is available at: entomology.unl.edu/ornamentals.

Disclaimer

This publication lists federally registered pesticides that are also registered with the Nebraska Department of Agriculture for the control of insects and mites affecting woody ornamentals and selected herbaceous perennials. Because of the large number of minor use labels in Nebraska, and rapid changes in chemical company and product names, only common names (active ingredients) of pesticides have been listed. A table of listed pesticides along with representative trade names and manufacturers is presented at the end of this circular. Pesticides in this circular are listed alphabetically and do not reflect or imply efficacy or endorsement.

A pesticide label is a legal document, and the law requires that pesticide applicators follow label instructions for use and disposal. This circular does not replace or supersede any information on the pesticide label. Neither the Department of Entomology at the University of Nebraska nor the Nebraska Department of Agriculture assumes liability resulting from the use of listed products. Always read, understand, and follow the pesticide label.

Since pesticide registration and usage can rapidly change, current information on Nebraska registrations, pesticide applications, labeled usage, worker protection, material safety data sheets (MSDS), and pesticide labels can found at the following Web sites:

- Nebraska Department of Agriculture Pesticide Registrations: *www.kellysolutions.com/ne/pesticideindex.htm*

- UNL Pesticide Education Resources: *pested.unl.edu/*
- Greenbook: *greenbook.net/*
- Crop Data Management Systems (CDMS): *www.cdms.net*
- UNL Department of Entomology: *entomology.unl.edu*

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How To Use This Guide

This guide is divided into three main sections. The first section, ***Principles of Integrated Pest Management***, presents information on developing and implementing an IPM program for the insects and mites affecting woody ornamentals and herbaceous perennials.

The second section, ***Insect and Mite Control Recommendations***, provides information on insect and mite pests commonly found associated with woody plants and herbaceous perennials, and an alphabetical list of insecticides/miticides labeled in Nebraska for each plant/pest combination. The insecticides/miticides are **NOT** listed in order of effectiveness or safety. This section also references other pages in this document that contains useful management information including control alternatives, treatment timing and application information and other helpful tips for each insect and mite pest.

The final section, ***Insecticide/Miticide Information***, contains the common names of the insecticides and miticides listed in this publication. They are arranged alphabetically along with common trade names, type of pesticide, and manufacturers. Also listed are relative oral and dermal toxicities of the pesticides listed in this guide.

Developing a Successful Pest Management Program

Insect management is important in the overall care of nursery and landscape plantings. This section presents information on developing an effective pest management program and making sound management decisions for the insects and mites affecting woody ornamentals and herbaceous perennials in Nebraska.

Implementing an IPM Program

An important aspect of a successful pest management program involves planning ahead to avoid or reduce pest problems as much as possible. Decisions made during the establishment and maintenance of a landscape, for instance, can influence pest development. Among these key decisions are selection of appropriate plant species and cultivars, site selection, weed and disease control, irrigation and fertility programs. Stressed plants are often more easily damaged by pests. Maintaining healthy, vigorous landscape and nursery plants is perhaps the best preventive insect management strategy.

Despite appropriate measures to avoid or reduce insect problems, pest populations can increase under certain conditions. Effective control of these pests requires a sound understanding of the growth habits and cultural requirements of the landscape plant; knowledge of the biology, behavior, life history and type of

damage caused by potential pests; and information regarding the time of year, growth stage of the plant and environmental conditions under which pest damage is most likely to occur.

Accurate Pest Identification. All nurseries and urban landscapes are inhabited by a diverse array of organisms including insects, spiders, mites and small animals. Most of these cause little or no damage and are generally considered non-pests. Others are beneficial and aid in the breakdown of organic matter, pollination of crops, or serve as natural enemies of pests. Only a few of the insects and mites present are actually plant-feeding pests. Because of the wide diversity of species present and the many similarities between pests and non-pests, it is important to be able to distinguish incidental and beneficial species from target pests. Insect and mite specimens can be taken to you local Extension office or sent to the University of Nebraska–Lincoln's Plant and Pest Identification Clinic (see instructions on p.??) for accurate identification.

Early Detection. Successful management of most nursery and landscape insect pests depends on early detection before they reach damaging levels. This can best be accomplished through frequent inspections to detect early signs of insects and their damage. When examining plants, look for natural enemies, such as lady beetles, lacewings, spiders, or parasitic wasps that may be reducing pest populations. Insect monitoring aids include magnifiers, drop cloths, sweep nets and sticky traps, as well as light and pheromone traps.

Insect Monitoring Techniques. All landscape plants should be regularly inspected for pest problems throughout the growing season. Monitoring allows the nursery or landscape manager to confirm the presence or absence of an insect or mite pest, determine the pest species present, assess the need for taking corrective measures, evaluate the efficacy of insecticide treatments, and develop site history information. Depending on the size of the planting, inspect all plants or a subsample of plants of each species. Plants of different species or at different growth stages may have different pest levels and should be inspected separately. Depending on the particular plant and pest involved, certain parts of a plant should be checked first. For example, spider mites are usually found on the underside of leaves.

Record-keeping. Accurate record-keeping is essential to make maximum use of information obtained during plant inspections. When you inspect nursery and landscape plants or turf, record the information in a quantitative fashion. For example, record the number of insects found per plant or leaf, rather than recording "many" or "few". After the growing season, review this information and plan to improve your pest management next year. You may detect patterns, such as more damage or pests on certain cultivars. Use this information next year to minimize pest problems. Effective record-keeping also allows you to know when to anticipate certain pest problems and plan ahead to deal with them. Also, information from regular inspections will permit you to evaluate which control practices are effective and which need to be modified in the future.

Pest Management Alternative

The following paragraphs describe some of the pest management alternatives available to the nursery or landscape manager.

Cultural Methods

Cultural methods involve manipulating the environment to make it less suitable for pest survival. These measures are usually preventive in nature and must be implemented before the insect reaches pest status.

Selection of Plant Materials. When recommending or selecting landscape plants, choose plant materials that are well-adapted to local soil and environmental conditions. Planting insect-resistant varieties is another valuable IPM tool. Plant resistance to insect pests has been found in many plants, although the degree of resistance may vary considerably from one cultivar to another. Most universities, nurseries,

garden centers and extension offices can provide information on resistant plant cultivars and those best adapted to local environments.

Plant Diversity. Planting patterns and the diversity of plant species in the landscape can influence the natural enemies of various insect pests. A diversity of plants increases the likelihood that some of them will harbor low levels of pest insects. This allows predatory and parasitic insects to survive periods of low pest populations on other plants. Many predatory and parasitic insects feed on either pollen, nectar or plant sap either as an essential part of their nutrition or as an alternate food source in the absence of prey insects. Diverse arrangements of flowering plants, with alternating bloom periods can increase the survival of many beneficial insects. Some cultivated plants that provide food resources include Phacelia, sweet alyssum, and many composite plants, such as tansy. Umbelliferous plants, such as caraway, dill, fennel and yarrow are also very attractive nectar sources to several groups of natural enemies.

Sanitation. Many insect and mite pests seek shelter or attempt to overwinter in plant residues. Overwintering forms include eggs on dead leaves, adults in plant stems and larvae or pupae in plant stems or in the soil. Removing dead branches or canes from trees and shrubs and raking and composting leaves, grasses and other plant debris helps eliminate many overwintering sites.

Mulches. Exercise caution in the use of heavy mulches during the growing season. Thick mulches of plant material will encourage the development of potentially damaging pests such as white grubs, millipedes, sowbugs and cutworms. However, a light mulch of straw or shredded plant material will moderate soil temperatures and conserve moisture. Apply plant residues and compost in the fall and deeply till into the soil. Increasing the organic content of soils helps retain moisture and improve fertility.

Water and Fertilizer Management. Adequate fertilization and watering encourages healthy, vigorous plant growth. For example, deep watering of landscape plants as needed is better than more frequent shallow watering. Although these practices do not prevent insect infestations, they tend to promote healthier growth and a more vigorous plant that is better able to tolerate pest damage.

Mechanical/Physical Methods

Mechanical/physical pest control methods include hand removal, use of screens, barriers, trapping devices, freezing, crushing, and grinding. Theses are the oldest, and in some cases, the simplest of all insect control methods. These tactics differ from cultural control measures because they are directed against the pest itself rather than the pest's environment. Mechanical methods are not widely used in commercial settings because they are often expensive and labor intensive.

Hand Removal. Remove large or readily visible insects by hand and destroy, or dislodge pests into a can containing a small amount of water and detergent. The egg masses of many insects can be scraped off or smashed. In the winter, removing the bagworm cases from juniper and witches' brooms from honeysuckle will help reduce infestations the following spring. Hand-removal requires considerable time, however, and may not be feasible for heavy infestations or when extensive nursery inventories on larger landscapes are involved.

Exclusion Using Screens and Barriers. Metal screens or cold frames covering high-value plants also can be used to exclude larger insects, birds and rabbits. Sticky bands placed around tree trunks will help reduce infestations of spring cankerworm and elm leaf beetles.

Trapping. Various kinds of traps can be used to monitor insect abundance, and in some cases, help reduce pest numbers. Yellow sticky traps are highly attractive to whiteflies, aphids, thrips, leafhoppers and other small flying insects, and are used by some commercial greenhouses for insect control. In outdoor settings, traps placed near susceptible plants may capture some invading insects before they can damage the plant. Other trapping devices, used largely against fruit flies and caterpillar pests, use pheromones or attractive scents to lure flying adult stages to their sticky surfaces. They are better used as monitoring tools than control measures.

Syringing. A vigorous stream of cold water from a hose can be used to dislodge aphids, other small insects and spider mites from landscape plants. Syringing must be carried out frequently, however, as it has little effect on eggs, and will not prevent some insects and mites from crawling back onto plants.

Biological Control

This important IPM strategy utilizes beneficial organisms including predators, parasites or insect pathogens to reduce pest populations. It can be implemented by releasing beneficial organisms into the landscape, or by modifying cultural, chemical and other control practices to conserve existing natural enemy populations. In general, effective use of this approach requires a detailed knowledge of predator/prey or parasite/host biology, accurate timing and careful application procedures.

Beneficial Insects and Mites. Natural populations of predators (e.g., lady beetles, lacewings, syrphid flies, praying mantids, wasps, and predaceous mites) and parasites (e.g., parasitoid wasps and tachinid flies) are valuable in reducing infestations of insect and mite pests. If these or other beneficial organisms are observed in the landscape, care should be taken to ensure their survival. If pest control should become necessary, corrective measures which minimize injury to beneficial organisms should be selected. Remember that a low level of pest infestation may need to be tolerated to attract and maintain natural enemy populations.

Disease-Causing Microorganisms. Certain disease-causing organisms or their products can also be used to reduce insect populations. Among the microorganisms known to attack insects are bacteria, fungi, viruses, protozoa and nematodes. Products containing certain pathogens or their derivatives (e.g., Avid, Conserve, Dipel, Naturalis TandO and others) are available through pest management supply companies and some pesticide manufacturers.

Wildlife. Insect-eating birds and small mammals can be attracted to landscape areas by planting trees and shrubs that provide cover and furnish berries for food. Birds can also be encouraged by providing water or nesting sites. It should be recognized, however, that some bird and animal species can be destructive to some landscape plants, and may do more harm than good.

Using Pesticides

Insecticides and miticides are the most powerful tools available for insect and mite control in urban landscapes. In many cases, they afford the only practical method of reducing pest populations that have already reached damaging levels. Insecticides have rapid corrective action in preventing further pest damage and offer a wide range of properties and application methods. Pesticides are relatively inexpensive, and their use often results in a substantial economic or aesthetic benefit. Some potential problems associated with insecticide use include the development of pest resistance, outbreaks of secondary pests, adverse effects on nontarget organisms including humans, pets, wildlife and beneficial insects, hazardous residues in our food supply and ground water contamination.

When insecticides are used in an IPM program, they should be carefully selected and their application timed with respect to the developmental stages of the target pest. Insect monitoring information can help pinpoint the optimal time for treatment. Proper selection and timing of pesticide applications are extremely important in obtaining the best possible control with the least adverse effect on the environment. Observe damage threshold levels (i.e., treat only when necessary) and limit treatments to infested areas whenever possible. When using any pesticide, ensure proper calibration of the application equipment. Remember, some biological control agents and new-chemistry insecticides require special handling and application techniques. Always read the product label and discuss application procedures with your supplier before use.

Factors Affecting Pesticide Performance

Many factors can affect pesticide performance and lead to product failures. Among the more important are:

Misdiagnosis of the Problem. An understanding of the biology, behavior, life history and type of damage caused by potential pests, and knowledge of the time of year, growth stage of the plant and environmental conditions under which pest damage is most likely to occur, will help prevent inappropriate control actions as a result of misdiagnosing of the problem.

Improper Timing. Most pests have a "vulnerable stage" when they are most susceptible to an insecticide application. Applications made before or after this stage are likely to be ineffective. For example, if a contact insecticide is applied to pine sawfly eggs, satisfactory control is unlikely. However, if the same insecticide is properly applied during the early larval stage, acceptable results are more likely.

Selecting the Wrong Insecticide. Some insecticides work very well for certain insects and not at all on others. For example, *Bacillus thuringiensis* is effective against most caterpillars (Lepidoptera), but has no activity against mites, beetles, flies, true bugs and insects in other orders. Make sure that the material being applied is specifically labeled for the target pest.

Using the Wrong Rate or Formulation. Thoroughly read and follow label directions. It is essential that applicators apply the correct formulation to the host plant to ensure control of the targeted pest.

Application Errors. The most common errors involve equipment problems such as clogged nozzles, worn fittings or incorrect pressure. Make sure sprayers are performing as intended and are delivering the proper amount of formulated material before each application. To reduce coverage errors, spray marker indicators can be helpful.

High Water pH. This is one the most frequently overlooked reasons for insecticide failures. The pesticide label will indicate the desired pH range of the water in the spray tank. In many parts of Nebraska the water pH is highly alkaline, in the range of 9 to 10. An insecticide that performs well at a pH of 5.5 can have its residual activity reduced from several days to several hours in alkaline water. Testing the pH level of your water can prevent potential insecticide failures.

Photodegredation. Photodegredation is the chemical breakdown of a substance such as when an insecticide is exposed to light. Botanical insecticides, older pyrethroids, *Bacillus thuringiensis* and entomopathogenic (beneficial) nematodes are particularly susceptible to photodegredation.

Volatilization. This condition involves evaporation of the insecticide from the plant's surface. Volatilization is a concern from the standpoint of reduced application effectiveness, as well as increased potential of human exposure. High air temperatures and windy conditions increase the volatility of many insecticides, so try to make applications on cool, cloudy, calm days.

Insecticide Resistance. This phenomenon occurs when insects or mites are able to tolerate higher and higher doses of an insecticide or miticide over time. Insecticide resistance is the greatest concern in situations where repeated applications of the same insecticide/miticide are made over an extended time. For example, twospotted spider mites have many generations each year in a typical nursery or landscape. If several generations are sprayed with the same miticide, the possibility of the mites developing resistance to that miticide is increased. Certain chlorinated hydrocarbons, carbamates, organophosphates and synthetic pyrethroids seem especially vulnerable to the development of insecticide resistance.

Practices that can be employed to reduce the likelihood of developing insecticide resistance include:

- Spot treating rather than using total cover sprays.
- Using insecticides/miticides with a short residual life.
- Alternating between classes of insecticides/miticides.
- Planting landscape plants with genetic resistance to insect pests.
- Selecting nonchemical methods of insect control.

Pesticide Toxicity

Signal words are required by law to indicate the relative toxicity of the formulated product in each container. The following table lists these signal words and indicates the hazards to humans. Additional information can be found at the Nebraska Department of Agriculture Web site's EPA link "How to read a pesticide label" (www.epa.gov/pesticides/label).

Acute Toxicity Measures and Warnings

Signal word	**DANGER POISON**	**WARNING**	**CAUTION**
Toxicity	Highly toxic May cause death	Moderately toxic Possible serious illness	Slighltly toxic May cause illness
Oral LD 50 mg/kg	0-50	50-500	500-5,000
Dermal LD 50 mg/kg	0-200	200-2,000	2,000-20,000
Inhalation LC 50mg/kg	0-0.2	0.2-2	2-20
Eye effects	Corrosive	Irritation persisting for 7 days	Irritation reversible within 7 days
Skin effects	Corrosive	Severe irritation	Moderate irritation
Probable oral lethal dose for 150 lb person	A few drops to a teaspoonful	Over one teaspoonful to one ounce	Over one ounce to one pint or one pound

Avoiding Plant Injury From Pesticides

- Do not apply liquid concentrates when the temperature is above 85°F (30°C), or any spray when the temperature is above 90°F (32°C). Wettable powder formulations are less likely to cause injury.
- Do not apply dormant oil sprays if the temperature is below 40°F (4°C) or if there is danger of the temperature falling below 40°F (4°C) within 24 hours.
- Do not apply horticultural/summer oils when the temperature is 80°F (27°C) or above and high humidity reduces the chance of the spray drying within an hour after the application.
- Never exceed the insecticide/miticide rate indicated on the pesticide label.
- Maintain continuous agitation of the spray tank to prevent spray materials from separating. Drain contents of long spray hoses back into the spray tank when more than a few minutes elapse between applications.
- Thoroughly clean sprayer after each use, and never use a sprayer that has contained a weed killer (herbicide) to perform other pest control activities.

Protecting Pollinators

Honey bees and other insect pollinators are essential to modern agriculture. Each year many pollinators are destroyed by pesticides, primarily insecticides. These losses can have a devastating impact on the beekeeper and reduce yields of insect-pollinated crops (apples, raspberries, cucurbits and many others). Many factors involving insecticide applications can affect the potential for pollinator losses. Among the more important are:

- ***Plant Growth Stage***. Severe bee poisoning most often results from spraying insecticides directly on flowering plants, either on the plant itself or on associated flowering weeds in the landscape or nursery. Do not apply insecticides to flowering plants.

- ***Relative Toxicity of the Chemical.*** Pesticides vary in their toxicity to pollinators (see *Toxicity of Pesticides to Honey Bees*). Most fungicides, herbicides and many miticides have relatively low toxicities to pollinators and can generally be used without serious harm. Insecticidal soaps and horticultural oils, if not directly sprayed, pose little hazard, and certain biological insecticides such as *Bacillus thuringiensis* (Dipel, Mattch) can be safely used around bees and other pollinators. Other products containing organophosphate, carbamate or synthetic pyrethroid insecticides are moderately to highly toxic to bees and other pollinators. These materials should only be used when bees are not actively foraging, which is generally in the evening hours.

- ***Choice of Formulation.*** Different formulations, even of the same pesticide, often vary considerably in their toxicity to bees and other insect pollinators. Dust formulations are typically more hazardous than sprays because they are picked up by the insect. Wettable powders often remain toxic on the plant for a longer time than an emulsifiable concentrate. Granular insecticides are the least hazardous to pollinators. Microencapsulated materials are particularly hazardous because the capsules have a tendency to adhere to the pollinator and return to the nest or hive where it remains toxic for an extended time.

- ***Residual Action.*** Residual activity of an insecticide is an important factor in determining its safety to pollinators. An insecticide that degrades within a few hours generally can be applied with minimal risk as long as bees are not actively foraging.

- ***Drift.*** Drift of spray applications can cause significant pollinator poisoning problems, particularly when drift reaches honey bee colonies or adjacent flowering weeds. In general, sprays should not be applied if wind speed exceeds 10 mph.

- ***Temperature.*** Temperature can have a substantial effect on the pollinator poisoning hazard. If the temperatures following an application are unusually low, insecticide residues can remain toxic to pollinators much longer.

- ***Time of Application.*** Evening applications of short residual insecticides can greatly reduce the potential for pollinator injury.

For more information on minimizing honey bee and other pollinator losses when using insecticides refer to University of Nebraska–Lincoln Extension NebGuide *Protecting Bees When Using Insecticides,* G98-1347 available at your local Extension office.

Toxicity of Pesticides to Honey Bees

The following pesticides are grouped according to their relative toxicity to honey bees.

Group I. High toxic: In general, these pesticides kill bees on contact during application and for one or more days after application.

abamectin
acephate
azinphos-methyl
bendiocarb
bifenthrin
carbaryl
chlorpyrifos
cyfluthrin
deltamethrin
diazinon
dicrotophos
dimethoate
esfenvalerate
fenpropathrin
fluvalinate
imidacloprid
lambda-cyhalothrin
lindane
malathion
methiocarb
naled
oxamyl
permethrin

Group II. Moderately toxic: Materials can be used with limited damage to bees if not applied directly to bees or on hives near the landscape or nursery. Correct application rate, timing, and method of application can reduce pesticide hazard.

disulfoton
endosulfan
Beauvaria bassiana
spinosad

Group III. Relatively non-toxic: These materials can be applied with little harm to bees. Regardless, always read and follow label instructions.

azadirachtin (neem)
Bacillus thuringiensis
dicofol
diflubenzuron
fenbutatin-oxide
horticultural oils
methoxychlor
pesticidal soaps
propargite
tebufenozide
trichlorfon

Pesticide Application Equipment

This section is based on material by David J. Shetlar in "Insect and Mite Control on Woody Ornamentals and Herbaceous Perennials," published by The Ohio State University and is used with the author's permission.

For Small Trees and Shrubs

Much of the success or failure of an insecticide/miticide application depends on using the proper equipment.

Hose-end Sprayers. These small sprayers screw onto the end of an ordinary garden hose. The spray container varies in size from a half pint to one quart and will deliver 1 to 15 gallons of spray. Insecticide is added to the sprayer on the basis of so many tablespoonfuls per gallon of spray delivered. The sprayers are operated by turning on the water and placing a thumb or other device over a small hole in the top of the lid. The insecticide is drawn from the container and mixed with the hose water as the water flows out the nozzle. A major disadvantage of this type of sprayer is that a wettable powder formulation will often plug the nozzle. An important advantage is the constant pressure; no pumping is needed to maintain pressure to deliver the spray.

Compressed Air Sprayers. These sprayers feature metal or plastic tanks that vary in size from one to three gallons. Air is pumped inside the sprayer with a plunger on the tank. The spray is delivered through an attached hose with a hand shut-off valve and a nozzle tip. Disadvantages of this type of sprayer are that it must be pumped frequently to maintain pressure, the tank must be transported, the nozzle tips are of the low-volume type, a relatively long time is required to empty the tank, and tanks can rust unless they are made of stainless steel or plastic. In spite of these disadvantages, compressed air sprayers are useful for many smaller pest control jobs in and around the nursery or landscape.

Knap-Sac Sprayers. These compressed air sprayers vary in size from three to five gallons and are strapped onto one's back. A handle pump is attached and is pumped continuously at a slow pace. The pumping builds pressure in the tank and allows the spray to be delivered through a hose and nozzle tip at an even, steady rate. It, too, is equipped with a hand shut-off valve. This type of sprayer is suited for spraying fairly large areas. Disadvantages of the Knap-Sac Sprayers are:

- Sprayers are expensive, however, a stainless knap-sac sprayer should last many years and handle most jobs in a nursery or landscape situation.
- When full of water, the sprayer becomes heavy.
- The sprayer must be pumped to maintain pressure.

Wheelbarrow Sprayers. These manually or motor operated hydraulic sprayers are mounted on a frame with one or two wheels. They generally have a capacity of 12 or more gallons. The motor-less type sprayer usually requires one person to operate the pump and another to direct the spray stream. Wheelbarrow sprayers are more expensive, but are suited for more extensive spray jobs.

For Larger Trees

The previously mentioned equipment is primarily designed for smaller jobs and would not be practical for spraying large trees. The following equipment is intended for control of pests on large trees.

Mist Blowers. These sprayers deliver concentrated amounts of insecticide to trees by means of a high volume, high velocity air stream. The insecticide is diluted primarily in air rather than in water. Spraying with a mist blower requires an experienced operator. Plant injury or poor distribution of the spray on the tree can result from an improperly operated machine.

Hydraulic Sprayers. These hydraulically operated sprayers deliver a lot of gallons, at high pressure, through a specialized spray gun attached to a pressure hose. This is one of the most common sprayers used for controlling pests on shade trees.

Insect and Mite Control Recommendations*

***Warning**: Some pesticide formulations can injure certain plant species. The product label will provide a list of plants (sites) and pests for which it is registered, and in many cases, a list of those plants known to be injured by the product. When making an application, be certain the product is specifically labeled for both the target pest and plant species.

Table I. Woody ornamental hosts, insect and mite pests and labeled insecticide treatments.[1]

Arborvitae	**Aphid**											
		X			**X**							
	Bagworm					X						
	Black Vine Weevil, Adult		X	X			X		X			
	Black Vine Weevil, larvae						X					
	Scale Insect, Fletcher Scale											
	Spider Mite, Spruce			X								
	Spider Mite, Two-spotted											
Ash	Aphid, Ash Leafcurl											
	Banded Ash Clearwing (Lepidoptera)								X			
	Borer, Ash-Lilac (Lepidoptera)								X			
	Borer, Redheaded Ash (Coleoptera)											
	Leafroller		X				X	X	X	X	X	
	Mite (Eriophyid) Ash Flowergall						X	X				
	Plant-Leaf Bug											
	Sawfly			X								
	Scale Insect, Oystershell							X				
	Scale Insect, Scurfy											
	Webworm, Fall											
Aspen	Aphid								X		X	
	Scale Insect, Black Willow							X				
	Scale Insect, Scurfy											
Azalea/												

Rhododendron	Black Vine Weevil, Adult	X				X		X				
	Black Vine Weevil, Larvae					X						
	Borer							X				
	Lace Bug		X				X					
	Leafminer		X									
Baldcypress	Bagworm	X			X				X			
Birch	Aphid											
	Birch Leadminer							X				
	Birch Leaf Skeletonizer	X										X
	Borer, Bronze Birch											
	Scale Insect								X			
	Webworm, Fall											
	Yellow Necked Caterpillar											X
Catalpa	Catalpa Sphinx Moth											
	Webworm, Fall	X										
Cotoneaster	Aphid		X									
	Cotoneaster Webworm											
	Leaf Crumpler						X	X	X			
	Sawfly		X									
	Spider Mite, Two-spotted											
	Uglynest Caterpillar		X									
Cottonwood/ Poplar	Borer, Cottonwood								X			
	Borer, Poplar		X						X			
	Cottonwood Dagger Moth		X									
	Cottonwood Leaf Beetle	X							X			
	Gall, Poplar Petiole							X				
	Leafminer		X						X			
	Scale Insect, Oystershell											
	Scale Insect, Scurfy											
	Webworm, Fall											

Dogwood	Borer, Dogwood									
	Scale Insect						X			
	Treehopper						X	X		
Elm	Aphid, Wooly Elm							X		
	Bark Beetle							X		
	Cankerworm		X					X		
	Elm Leaf Beetle		X					X	X	X
	Leafhopper							X		
	Leafminer, Elm									
	Mite, (Eriophyid) Leaf Gall	X					X	X		
	Scale Insect, European Elm				X					
Euonymous	Scale Insect, Euonymous			X						
Firs	Adelgid, Balsam Wooly									
	Adelgid, Cooley Spruce Gall							X	X	
	Aphid, Balsam Twig							X		
	Scale Insect, Pine Needle						X			
	Spider Mite, Spruce									
	Spider Mite, Two-spotted									
Firethorn	Aphid			X						
	Lace Bug, Hawthorn								X	
Flowering Trees	Aphid, Wooly Gall Aphid							X		
	Borer, Flatheaded Apple Tree									
	Borer, Peachtree									
	Borer, Roundheaded Apple Tree								X	
	Cankerworm									
	Fruittree Leafroller			X		X		X	X	X	X
	Leaf Crumpler			X						
	Leafhopper		X					X	X	
	Oriental Fruit Moth					X		X		
	Pear Psyllid							X		
	Sawfly, (Pearslug)									

	Scale Insect, Oystershell					
	Scale Insect, Scurfy					
	Spider Mite, European Red					
	Spider Mite, Two-spotted					
	Tent Caterpillar					
	Uglynest Caterpillar	X		X	X	
	Unicorn Caterpillar					
	Webworm, Fall					
	Yellow Necked Caterpillar					
Forsythia	Spider Mite					
	Scale Insect, Oystershell				X	
	Scale Insect, Scurfy					
Hackberry	Caterpillar, Hackberry Butterfly					
	Gall, Hackberry Blister	X				
	Gall, Hackberry Nipple				X	
	Gall, Hackberry Petiole				X	
	Lace Bug					
	Leafminer					X
	Mite, (Eriophyid) Witches Broom			X	X	
Hawthorn	Aphid, Wooly				X	
	Borer, Flatheaded Apple Tree					
	Borer, Roundheaded Apple Tree					
	Lace Bug				X	
	Leafhopper					
Hawthorn (cont.)	Scale Insect, Cottony Maple					X
	Scale Insect, Oystershell					
	Scale Insect, Scurfy					
	Scale Insect, Terrapin					
	Webworm, Fall					
	Yellow Necked Caterpillar					X

Honeylocust	Borer, Locust								X			
	Honeylocust Podgall								X			
	Leafhopper											
	Plant Bug, Honeylocust											
	Scale Insect, Oystershell											
	Spider Mite, Honeylocust											
	Webworm, Fall											
	Webworm, Mimosa									X		
Honeysuckle	Aphid, Honeysuckle											
	Spider Mite							X				
Juniper/Cedar	Bagworms					X						
	Borer, Ash-Lilac (Lepidoptera)									X		
	Scale Insect, Juniper											
	Scale Insect, Oystershell											
	Spider Mite, Spruce											
	Spider Mite, Two-spotted											
	Spittlebug		X					X				X
	Thrip									X		X
Linden	Aphid											
	Bagworm		X	X		X				X		
	Borer			X						X		
	Lace Bug, Basswood								X			
	Leafhopper											
	Mite, (Eriophyid) Spindle Gall	X						X	X			
	Tussock Moth Caterpillar											
	Webworm, Fall											
	Yellow Necked Caterpillar											X
Locust	Borer, Locust								X			
	Skipper Caterpillar			X								
	Spider Mite											
Magnolia	Scale Insect, Magnolia Scale									X		

Maple	Aphid										
	Bark Beetle										
	Borer				X						X
	Greenstriped Mapleworm								X	X	X
	Leafhopper			X	X						X
	Mite, (Eriophyid) Erineum	X							X	X	
	Mite, (Eriophyid) Maple Bladdergall										
	Pigeon tremex										
	Scale Insect, Oystershell										
	Scale Insect, Scurfy										
	Webworm, Fall										
Mountain Ash	Aphid, Wooly									X	
	Borer										X
	Spider Mite										
	Webworm, Fall										
Oak	Aphid										
	Borer, Flatheaded Apple Tree										
	Borer, Roundheaded Apple Tree										X
	Carpenter Worm										X
	Gall Wasp									X	
	Lace Bug, Oak									X	
	Sawfly, Oak			X	X					X	
	Scale Insect, Iecanium										X
	Scale Insect, Oak Kermes										
	Scale Insect, Obscure										
	Twig Girdler									X	
	Twig Pruner									X	
	Webworm, Fall										
	Yellow Necked Caterpillar										
Pine	Adelgid, Pine Bark										

	Aphid, Conifer										
	Aphid, Greenspotted										
	Bark Beetle										
	Borer, Zimmerman Pine Moth										
	European Pine Shoot Moth								X		
	Ips Bark Beetle										
	Jack Pine Budworm					X			X	X	
	Metallic Pitch Moth										
	Nantucket Pine Tip Moth		X						X		X
	Pales Weevil									X	
	Pine Needle Midge										
	Pine Needle Sheathminer										
	Pine Sawyer Beetle										
	Sawfly, European Pine										
	Scale Insect, Pine Needle							X			
	Scale Insect, Pine Tortoise		X								
	Spider Mite, Spruce										
	Spider Mite, Two-spotted										
	Spittlebug		X							X	
Privet	Borer, Privet (Lepidoptera)										
	Scale Insect									X	
	Thrip, Privet	X	X					X	X	X	X
Redbud	Borer										
	Leafhopper		X	X							
	Leafroller / Leaffolder Redbud			X							
	Leaftier			X							
	Treehopper							X	X		
	Webworm, Fall										
Rose	Aphid							X	X		
	Cane Girdler										
	Green Fruitworm										

	Leafcutters Bee						
	Leafhopper						
	Rose Chafer						X
	Sawfly, (Roseslugs)					X	
	Spider Mite, Two-spotted						
Serviceberry	Aphid		X				
	Borer						
	Lace Bug					X	
	Sawfly, (Pearslug)						
	Scale Insect				X		
	Spider Mite, Two-spotted						
Spirea	Fruittree Leafroller						
	Leaftier		X				
Spruce	Aphid						
	Bagworm			X			
	Scale Insect, Pine Needle						
	Spider Mite, Spruce						
	Spider Mite, Two-spotted						
	Spruce Needleminer					X	
Sycamore	Aphid		X				
	Lace Bug, Sycamore					X	
	Leaffolder		X				
	Leaftier		X				
Viburnum	Aphid		X				
	Borer						
	Spider Mite, Two-spotted						
Walnut	Aphid		X				
	Spider Mite						
	Walnut Caterpillar					X	X
	Webworm, Fall						

Willow	Aphid		X		
	Borer				
	Leaf Beetle			X	
	Leafhopper	X	X		
	Scale Insect, Oystershell				
	Scale Insect, Scurfy				
	Spider Mite				
	Webworm, Fall				
Yew	Black Vine Weevil, Adult			X	X
	Black Vine Weevil, Larvae			X	
	Scale Insect, Fletcher Scale				
	Taxus Mealybug				X

Table II. Herbaceous hosts, insect and mite pests and labeled insecticide treatments.[1]

HostInsect

Aster Lace Bug X X

X

	Leafhopper, Aster				X								
Crysanthemum	Aphid					X			X	X			
	Lace Bug											X	
Columbine	Leafminer, Columbine	X	X				X					X	X
Daylily	Spider Mite		X					X					
Hosta	Aphid								X	X			
	Slug										X		
Iris	Aphid							X		X			
	Borer, Iris		X					X					
Peony	Aphid								X	X			
	Scale Insect, Oystershell			X						X			
Phlox	Lace Bug											X	
	Plant Bug, Phlox			X				X	X			X	

[1]Farm Chemicals Handbook 1997 (Meister Publishing Co., Willoughby, OH).
* Restricted Use Pesticide (RUP).

Table III. Management recommendations for insect and mite pests found in woody ornamentals.

Insect	*Entry Number*	*Recommendation*
Adelgids, Balsam Woolly		Treatment needs to be applied before bud break to kill overwintering females. Thorough coverage is critical, and multiple applications may be necessary.
Adelgids, Cooley Spruce Gall		Overwintered females lay eggs on terminal growth. Hatching nymphs can be found feeding on new growth.
Adelgids, Pine Bark		Treatment is usually not warranted. Apply spray to trunk and inner branches.
Ants		Usually associated with honeydew-producing insects, e.g., aphids, scales, leafhoppers, etc. Eliminate ants by controlling these pests. Baits are effective on some species.
Aphids		Treat when aphid numbers are increasing and plant damage is apparent. Monitor new growth for signs of recolonization, for example shed skins, honeydew, and ants. Overwintering stages can be controlled with doormat oil sprays. Retreat site as necessary.
Aphids, Balsam Twig		Aphids overwinter as eggs. Treat hatching crawlers in May.
Aphids, Conifer		Thorough coverage is essential to successful treatment.
Aphids, Greenspotted		Thorough coverage is essential to successful treatment.
Aphids, Wooly		Kill hatching eggs in mid spring.
Aphids, Wooly Elm		Mechanically prune out infested branches. Treat hatching wingless females in early spring before migration occurs to expanding leaves.
Bagworm		Remove the previous year's bags from the tree before May 1. Treat larvae while bags are small, around mid June. Use *Bt* to conserve natural enemies.
Banded Ash Clearwing (Lepidoptera)		Spray the trunk and limbs during adult egg laying in August.

Bark Beetle, Ips		Remove and destroy dead or dying trees/branches immediately. Treat bark crevices in early spring to kill overwintering populations before adults emerge. Horticultural oils and soaps may provide some control.
Bark Beetle, Pine		Chip or burn dead or dying infested trees in early spring before the beetles emerge. Use a residual spray to prevent insect feeding in the spring.
Bark Beetles, Elm		Chip or burn dead or dying infested trees in early spring before beetles emerge. Use a residual spray to prevent feeding in the spring.
Bark Beetles, Maple		Chip or burn dead or dying infested trees in early spring before beetles emerge.
Insect	*Entry Number*	*Recommendation*
Birch Leaf Skeletonizers		Treat young larvae in mid spring. Treat when caterpillars are actively feeding.
Black Vine Weevil		Adult weevils emerge from the soil from early to mid May continuing into early June. Repeated foliar insecticide applications during emergence will provide some control. Soil drenching applications are also a treatment option, although they're not thought to be as effective.
Borer, Ash/Lilac		Spray trunk and limbs during adult egg laying, early to mid May.
Borer, Cottonwood		Treat lower limbs and trunk to control newly hatched larvae during June and July.
Borer, Flatheaded Appletree		Apply insecticides beginning in mid May.
Borer, Iris		Remove and destroy previous year's foliage before April 1. Destroy heavily infested rhizomes. Apply insecticide when fans are approximately 6 inches high. Multiple applications may be necessary. Larvae can be killed by squeezing infested leaves.
Borer, Locust		Treat when females are laying eggs in September.

Borer, Peachtree		Apply insecticides beginning in early July. Use pheromone traps to monitor adult activity.
Borer, Poplar		Treat lower limbs and trunk to control newly hatched larvae during June and July.
Borer, Privet		Treat in early May with additional applications in mid May and early June. Spray canes/stems to point of runoff.
Borer, Roundheaded Appletree		Apply insecticides beginning in June.
Borers		Application timing is critical. Apply insecticides to point of runoff. Multiple applications are usually necessary. Remove and destroy diseased limbs. Pheromone traps are useful in monitoring for adult activity.
Borers, Dogwood		Use pheromone traps to monitor earliest activity. Adult activity appears after flowering and continues into early fall.
Borers, Zimmerman Pine Moth		Application timing is critical for successful control. Make 2-3 applications at 10-14 day intervals beginning in mid April and again in late August. Spring application is critical to control.
Bronze Birch Borer		Treat four times through the months of May June with applications at 10-day intervals.
Cankerworms		Band trees with a sticky adhesive (March/April for spring cankerworm and September/October for fall cankerworm) to prevent wingless females from reaching egg laying sites.
Insect	*Entry Number*	*Recommendation*
Carpenterworm		Moths are active June - July. This insect requires more than one year to complete its life cycle. Eggs are deposited on the bark and lower parts of the trunk. Spray the trunk in late May and late June. Successive applications may be warranted in heavy infestations.
Catalpa Sphinx Caterpillar		Treatment usually not recommended.
Caterpillars		Apply treatment when caterpillars are small and damage appears to be increasing. Use *Bt* to conserve natural enemies. Horticultural

		oils and soaps may provide control when caterpillars are small.
Cotoneaster Webworm		Treat when caterpillars are small, before leaves have been “rolled” or “folded”. Use *Bt* to conserve natural enemies.
Cottonwood Leaf Beetles		Insects are highly mobile (new infestations can emerge via recolonization from untreated areas). Treat when beetles or larvae are present and damage is increasing.
European Pine Shoot Moths		Application timing is critical to control. Overwintering larvae move to new shoots in early spring. A chemical application in early to mid May can be effective. Repeated applications may be necessary.
Fall Webworm		Hand removal of webbing will provide effective control. Spray foliage when caterpillars are young and before webs are present If spraying after webs are present, use sufficient pressure to penetrate webbing.
Fruittree Leafrollers		Application timing is critical to control. Treat when caterpillars are small, before leaves have been “rolled” or “folded”. Use *Bt* to conserve natural enemies.
Gall Wasp		Can include: Apple, Blister, Bullet, Hairy, Midrib, Petiole, Woolyleaf/Flake, and Wooly Galls. There are few chemicals labeled for gall-forming insects. Treatment is rarely necessary.
Galls, Honeylocust Podgall		Treat at bud break. There can be several generations per year.
Grasshoppers		Application timing is critical, applications should be made to hatching areas where young nymphs are found. Insecticides are less effective against adults.
Greenstriped Mapleworm		Two generations per year. Use *Bt* to conserve natural enemies.
Hackberry Blister Gall		Treat during leaf expansion. Multiple applications may be necessary.
Hackberry Nipple Gall		Treat during leaf expansion. Multiple applications may be necessary.
Insect	*Entry Number*	*Recommendation*

Hackberry Petiole Gall	Treatment is usually not recommended
Jack Pine Budworms	Treatment is most effective during the emergence of larvae, which usually occurs during pollination. Damage can result in the loss of the tree's leader.
Lace Bugs	Apply treatment when leaves begin to show stippling injury. Direct insecticide to the underside of the leaves. Multiple applications may be necessary.
Lace Bugs, Chrysanthemum	Adults first appear in early spring. Remove and destroy leaves, stems, and debris before March.
Lace Bugs, Phlox	Adults first appear in early spring. Remove and destroy leaves, stems, and debris before March.
Leaf Beetles, Elm	Treat foliage when larvae is present and damage is increasing. Treat in mid June and mid July. Spray trunk when larvae are coming down to pupate. Collect and destroy pupae at base of truck.
Leaf Crumplers	Treat in April-May when caterpillars are small. After leaves have been "rolled" or "folded", control will be limited. Use *Bt* to conserve natural enemies.
Leafcutter Bees	Treatment is usually not recommended and is usually not effective.
Leaffolders	Application timing is critical. Treat when caterpillars are small and before leaves have been "folded" or "rolled".
Leafhoppers	Treat when feeding is present.
Leafhoppers/Treehoppers	Treat when nymphs and or adults is present and plant damage is increasing. Thorough coverage is essential. Multiple applications may be necessary.
Leafminers	Use contact insecticides against adult leafminers. Systemic insecticides such as acephate, dimethoate, or imidacloprid are needed for larvae within mines.
Leafminers, Columbine	Adults lay eggs on emerging leaves in the spring. Clip and destroy mined leaves.

		Use systemic insecticides when larvae and damage is present.
Leafrollers/Leaffolders, Redbud		Application timing is critical. Treat when caterpillars are small and before leaves have been “folded” or “rolled”.
Leaftiers		Application timing is critical. Treat when caterpillars are small and before the leaves have been “folded” or “rolled”.
Mealybugs		Treat when cottony egg masses are present and damage is increasing. Multiple applications may be necessary.
Metallic Pitch Nodule Makers		Treatment is rarely necessary.
Insect	*Entry Number*	*Recommendation*
Mite, Witches Broom		Severe infestations are rare but can occur. Trees with a history of severe infestations should be treated twice at 10-day intervals when leaves are expanding.
Mites (Eriophyid)		Dormant oils may be used to kill overwintering populations. Few chemicals are labeled for gall-forming insects. Treatment is rarely necessary. Prune off previous years gall. Treat mites in spring when trees begin to flower. Thorough coverage is important.
Nantucket Pine Tip Moth		Pine tip moths emerge in early spring. Control is achieved when larvae are small and infesting the pine needles before moving on to tree buds. In small plantings infested pine tips can be pruned off and destroyed.
Oak Gall		Sanitation of leaves in the fall is important for insect control. As wasps begin to emerge-apply insecticide treatment. Control with insecticides is difficult to achieve.
Oriental Fruit Moth		Treat before caterpillars have entered a terminal stem. Use pheromone traps to monitor adult activity.
Pales Weevil		Destroy or remove stumps before mid June. Spray seedlings in late April - June and again in August - September to protect terminal growth.

Pear Psyllids		Treat when adults and or nymphs are present and damage is increasing.
Pigeon Tremex		Treatment is generally not recommended because this horntail wasp usually attacks only dead, severely damaged or declining trees.
Pine Needle Sheathminer		None labeled for Nebraska
Pine Sawyer Beetle		Timely sanitation of dead and dying trees is critical to the management of this pest.
Plant Bugs, Honeylocust		Spray in early spring when leaflets are forming. Plant bugs are highly mobile, new infestations can emerge via migration from an untreated area.
Plant Bugs, Phlox		Remove flowering stalks and debris after the first frost to destroy overwintering eggs. Eggs hatch in early spring.
Plant/Leaf Bugs		Treat when nymphs appear in early spring. Multiple applications may be necessary.
Poplar Petiole Galls		Treatment is not usually recommended.
Rose Cane Girdler		Beetles emerge from infested stems in May and early June. Spray canes twice in late May and early June. Sanitation of infested canes is important in pest control.
Insect	*Entry Number*	*Recommendation*
Rose Cane Girdler		Remove the damaged stems of both roses and raspberries in fall to remove overwintering stages. Branches that die off in late summer probably have adults or larvae in them. Spray lower stems in May-July to target emerging adults, if a large infestation is present.
Rose Chafers		Chafers are highly mobile and can re-infest from an untreated area. Treatment in June - early July will provide only a short period of control. Rose chafers pupate in the soil.
Sawflies		Most species feed in clusters. Treat when larvae are small and actively feeding. Spot treatments may be effective.

Sawflies, European Pine		Larvae prefer older needles and feed in groups. Hand removal provides effective control. Horticultural oils and soaps may provide control when larvae are small. Insects can be washed off with a direct spray of water from a hose.
Sawflies, Roseslugs		Treat when feeding larvae are present.
Scale Insect, Magnolia		Treatment rarely necessary. Insect overwinters as a young nymph.
Scale Insects		Apply dormant oil sprays before bud break to kill overwintering stages. Treatment is most effective during crawler stage. Thorough coverage is important. Trunk injections may be available.
Scale Insects, Fletcher		Scales overwinter as second instar nymphs. Treat for hatching crawlers in June and July.
Scale Insects, Oystershell		Two generations per year. Treat in late May when crawlers begin to appear. Multiple applications may be necessary.
Scale Insects, Pine Needle		Treat crawlers in late May through early June and again in late July through early August.
Scale Insects, Pine Tortoise		Treat for young nymphs in May. Monitor crawlers and treat in late June and July.
Scale Insects, Scurfy		One generation per year.
Slugs		Slugs feed at night and prefer a cool, wet habitat. It is beneficial to keep plant material such as leaves off the ground. Applying insecticides late in the afternoon improves control. Baits are only effective during cool, wet conditions. Watering less can suppress damage.
Spider Mite, European Red		Most abundant during hot, dry weather.
Spider Mite, Spruce		Most abundant in spring and early summer. Multiple applications may be necessary.
Insect	*Entry Number*	*Recommendation*
Spider Mite, Two-spotted		Most abundant during hot, dry weather.
Spider Mites		Distinguish between plant feeding and predatory mites. Treat when colonies are small. Thorough coverage is essential and

	multiple treatments may be necessary. Use oils and soaps when infestations are low. Dormant oils in winter may be effective.
Spittlebugs	Light infestations rarely damage plants. Small infestations can be washed off with a garden hose.
Spruce Needleminers	Remove webbing. Treat in the spring when larvae are small. Web treatment in the fall provides limited control.
Taxus Mealybug	Use dormant oils to reduce overwintering stage of insect. Thorough coverage is important for effective control.
Tent Caterpillar	Caterpillars become active early to late May. Hand removal of webbing will provide effective control. If spraying after webs are present, use sufficient pressure to penetrate webbing.
Thrips	Repeated applications may be necessary. Direct insecticide to the underside of the leaves.
Thrips, Privet	Damage is rare on trees and shrubs. Treat if thrips are present and damage is apparent.
Twig Girdlers	Chemical control is not practical. Collect fallen twigs and remove dead branches. Destroy before late spring.
Twig Pruners	Chemical control is not practical. Collect fallen twigs and remove dead branches. Destroy before late spring.
Uglynest Caterpillars	Prune and destroy webbed nests.
Viburnum Shoot Borer	Infestations are rare. Prune wilted shoots from plant.
Walnut Caterpillars	Control caterpillars when aggregated on trunk and lower branches.
Webworm, Mimosa	Two generations per year. Application timing is critical. The first generation appears in June with the second generation following in July or August. After leaves have been “folded”, control is limited. Spray with *Bt* when larvae are small. Use a residual insecticide on the second generation.

Yellownecked Caterpillars	Horticultural oils may provide control when larvae are small.

Table IV. Information on listed insecticides and miticides.

			Pesticide Toxicity		
Pesticide	*Trade Names Manufacturers*	*Classification*	*Oral LD 50[1]*	*DermaL LD 50[1]*	
abamectin	Avid/Abacide Syngenta/Mauget	Microbial toxin	650	>2000	
acephate Ortho/Microflo	Orthene, Isotox IV	Organophosphate	980	>10250	Valent,
azadiractin Trilogy Corp,	BioNeem, Azatin, Ornazin Olympic	Botanical	>5,000	>2,000	Thermo
azinphos-methyl	Azinphos M *	Organophosphate	4-16	150-220	Gowan
Bacillus thuringiensis var kurstaki Ecogen	Dipel Mattch, others	Microbial	—	—	Abbott,
Beauveria bassiana Biosciences	Naturalis T & O	Microbial	—	—	Troy
bendiocarb Scotts-Sierra	Dycarb, Closure	Carbamate	156	>1000	Drexel,
bifenthrin	Talstar	Pyrethroid	375	>2000	FMC
carbaryl Lesco	Sevin, Carbaryl	Carbamate	246	>4000	Drexel,
chlorpyrifos	Dursban *, others DowAgro, others	Organophosphate	96	>2000	
cyfluthrin Olympic	Tempo, Decathalon	Pyrethroid	826	>2000	Bayer,
deltamethrin	Deltagard, Suspend	Pyrethroid	128	2000	Agrevo
diazinon	Diazinon, Specracide Andersons, Bonide	Organophosphate	300	3600	
dicofol	Kelthane	Chlorinated hydrocarbon	570-595	2000-5000	Zeneca
dicrotophos Mauget	Inject-a-cide B (Bidrin)*	Organophosphate	17	224	J.J.
diflubenzuron	Dimilin Crompton Crop Protection	Insect growth regulator	>4640	>10000	
dimethoate Micro Flo	Dimethoate	Organophosphate	235	>400	Helena,
disulfoton	Di-syston *	Organophosphate	4	10	Bayer
endosulfan Bayer	Phaser, Thiodan Thionex	Chlorinated hydrocarbon	160	359	FMC,

esfenvalerate	Asana *	Pyrethroid	458	>2000	DuPont
fenbutatin-oxide	Vendex *	Organotin	2631	>2000	Griffin LLC, Ortho, DuPont
fenpropathrin	Tame *	Pyrethroid	71-164	>2000	Valent
fluvalinate	Mavrik	Pyrethroid	261-282	20000	Sandoz
hexythiazox	Hexygon, Savey	Carboxamide	5000	>5000	Gowan
imidacloprid	Marathon, Merit	Chloronicotinyl	450	>2000	Bayer, Olympic
lambda-cyhalothrin	Scimitar	Pyrethroid	68-79	632-664	Syngenta
lindane	Lindane	Chlorinated hydrocarbon	125	1000	Prentiss
malathion	Malathion	Organophosphate	1000	4100	Micro Flo, Prentixx
methiocarb	Mesurol	Carbamate	20	>5000	Gowan
methoxychlor	Methoxychlor	Chlorinated hydrocarbon	6000	>6000	Prentiss
naled	Dibrom	Organophosphate	272	1100	Valent
oils	Sunspray, Numerous	Hydrocarbon oil	—	—	Numerous
oxamyl	Vydate	Carbamate	37	2960	DuPont
permethrin	Astro, Eight, others	Organophosphate	430-4000	>2000	FMC, Bonide
soaps	Insecticidal Soaps	Fatty Acid Salts	—	—	Numerous
spinosad	Conserve	Microbial	3783	>5000	DowAgro
tebufenozide	Confirm, Mimic	Insect Growth Regulator	>5000	>5000	DowAgro
trichlorfon	Dylox	Organophosphate	250	>2100	Bayer, Andersons

[1]Farm Chemicals Handbook 1997 (Meister Publishing Co., Willoughby, OH).
*Restricted Use Pesticide (RUP)

Using the Plant and Pesticide Diagnostic Clinic at UNL

The University of Nebraska–Lincoln Plant and Pest Diagnostic Clinic (PandPDC) is operated by Extension and offers skilled and objective diagnostic services by professionals from the Departments of Plant Pathology, Entomology, and Horticulture and Agronomy (Weed Science). In addition to accurate diagnosis of your pest problem, you will be provided with the most current information and recommendations. Entomology specialists will identify insects, mites, spiders and other related arthropods submitted from a variety of indoor and outdoor sources, including field crops, horticultural crops and ornamentals, structural and aquatic environments, as well as humans, livestock and pets. Please provide information on the level of infestation and what host plants or materials are infected along with the sample. Also include a history of the setting from which the sample was removed. Soft-bodied specimens (for example are insect larvae, aphids,

mites and spiders) should be placed in a tight-sealing bottle with a liquid preservative such as alcohol or vinegar. Hard-bodied specimens (beetles, bugs, moths, ants and flies) should be wrapped in loose tissue and placed in a crush-proof container. Living specimens (whether soft- or hard-bodied) should be placed with the host plant or damaged material along with some loose tissue into a ventilated container. Each sample should include the appropriate fee (check or money order) made out to the University of Nebraska. The fee depends on the level of diagnosis desired, as indicated below:

- **Standard** — $5.00: Standard diagnosis involves examination with the aid of a microscope or other basic diagnostic tools.

- **Special** — $10.00: This level of diagnosis requires laboratory analysis, extensive research, incubation, culturing or rearing to another life stage.

- **Advanced** — $20.00: Advanced laboratory techniques and analysis are required. Among these are assays for viruses or nematodes.

Follow specific instructions for sample preparation on the back of the Specimen ID Form, which can be picked up at your local Extension Office or UNL Research and Extension Center prior to mailing. Send samples to this address:

Plant and Pest Diagnostic Clinic
University of Nebraska–Lincoln
448 Plant Sciences
P.O. Box 830722
Lincoln, NE 68583-0722

Pesticide Safety Telephone Hotlines

Non-Emergency Telephone Numbers

National Pesticide Information Center..... (800) 858-7378
— for medical and consumer information on pesticides

Chemical Referral Center (weekdays only)..... (800) 262-8200

referrals to manufacturers on health and safety
related to chemicals, 9:00 a.m. - 6:00 p.m. EST

Emergency Telephone Numbers

The Poison Center, Omaha ..... (800) 955-9119
for aid in human poisoning cases

Pesticide Accident Hotline (CHEMTREC) ..... (800) 424-9300

for help involving spills, leaks, fires

Nebraska State Patrol..... (800) 525-5555
to report chemical spills or releases
to report motor vehicle accidents