Pesticide Information

Pesticide Compatibility with Biological Control: Updates 2006

Adapted from Sadof, C.S., and Raupp, M.J. 1999.
In (eds McCullough, D.G., S.A. Katovick., D.L. Mahr, D.D. Neumann, C.S. Sadof and M.J. Raupp) Biological control of Insect pests in forested ecosystems: A manual for foresters, Christmas tree growers, and landscapers. Michigan State Extension Bulletin E-2679, 122 pp.

Pesticide Common Name (Chemical Class)	Compatiblity1	Comment
bifenazate (other)	HC	This miticide does not kill predatory mites or eriophyid mites.
carbaryl (carbamate)	NC	Repeated use may stimulate spider mite reproduction. Broad spectrum activity.
chlorpyrifos (organophosphate)	NC	The chemical standard for borer control. Long residual. Broad spectrum activity.
clofentazine (tetrazine)	HC	This miticide does not kill predatory mites or eriophyid mites.
cyfluthrin (pyrethroid)	NC	
dicofol (organochlorine)	NC	Very long residual miticide. Kills mite predators.
diflubenzuron (insect growth regulator)	SC	Moderate residual. Kills immature stages. Pupal stage parasitoids are not killed.
fenitrothion (organophosphate)	NC	Long residual. Broad spectrum activity.
fluvalinate (pyrethroid)	NC	Long residual. Broad spectrum activity.
Heterorhabditis bacteriophora (entomophagous nematode)	C	Very low toxicity to humans and non-targets. Wasp parasitoids with silken cocoons are not killed.
hexythiazox (thiazolidine)	HC	Kills only spider mite nymphs and eggs. Long residual. Does not kill predators.
horticultural oil	C	Inactive when dry. Kills soft-bodied insects. Pupal stage parasitoids not killed.
imidacloprid (chloronicotinyl)	NC	Ability to kill predaceous plant bugs can cause spider mite outbreaks. Long residual when systemically applied.
insecticidal soap	C	Inactive when dry. Kills soft-bodied insects. Pupal stage parasitoids not killed.

[1] HC = Highly compatible, C = Compatible, SC = Somewhat compatible, NC = Not compatible

Pesticide Compatibility with Biological Control (continued)

Pesticide Common Name (Chemical Class)	Compatiblity1	Comment
lambda-cyhalothrin (pyrethroid)	NC	Very long residual. Broad spectrum activity.
malathion (organophosphate)	NC	Moderate residual. Broad spectrum activity.
methoxychlor (organochlorine)	NC	Very long residual. Broad spectrum activity.
neem oil (botanical)	C	Insect growth regulator derived from seeds of neem tree. Kills immature stages. Pupal stage parasitoids not killed.
oil (see horticultural oil)		
oxythioquinox (dithiocarbonate)	NC	Long residual. Broad spectrum activity miticide.
oxydementon-methyl	NC	Long residual. Broad spectrum activity.
permethrin (pyrethroid)	NC	Moderate residual. Broad spectrum activity.
phosmet (organophosphate)	SC	Reportedly low impact on spider mite predators in orchards with long history of pesticide use. Effect on predators in landscape unknown.
pyradiben	NC	Lasting effects on whiteflies, mites and predatory mites.
pyriproxifen (insect growth regulator)	SC	Very effective on armored scales but also kills parasitized scales.
pyrethrins (botanical)	SC	Very short residual but broad spectrum activity. Prevents additional injury and sets the stage for future conservation and augmentation efforts.
spinosad (microbial)	C	Very short residual. Toxic to adult wasp parasitoids. Not toxic to some important predators.
Steinernema carpocapsae (entomophagous nematode)	HC	Very low toxicity to humans and non-targets. Wasp parasitoids with silken cocoons are not killed.
trichlorfon (organophosphate)	NC	Long residual. Broad spectrum activity.

[1] HC = Highly compatible, C = Compatible, SC = Somewhat compatible, NC = Not compatible

Ornamentals: Information About Insecticides/Miticides

David Shetlar and Daniel Herms. 2003.
Insect and mite control on woody ornamentals and herbaceous perennials,
The Ohio State University Extension Bulletin 504.

Pesticide (Common Name)	Trade Name(s)	Classification	Oral LD_{50}[1] (mg/kg)[2]	Dermal LD_{50}[1] (mg/kg)[2]	Manufacturer
abamectin	Avid	microbial toxins	650	>2000	Syngenta
acephate	Orthene, Isotoxiv, Orthenex	organophosphate	980	10250	Valent, Agriliance, TopPro
azadirachtin (=neem, azatin)	Azatin, BioNEEM	botanical	>5000	>2000	Scotts, Olympic
Bacillus thuringiensis var. *kurstaki*	Biobit, Bactospeine, Caterpillar Attack, Dipel, Javelin, Larvo-BT, Thuricide, Victory, and others	spores + crystalline delta-endotoxin, microbial	none	none	Numerous - Abbott, DuPont,
Bacillus thuringiensis var. *tenebrionis* (=*san diego*)	M-One, Novodor	microbial	none	none	Valent
Beauveria bassiana	*Beauveria*, Naturalis-O	fungus	none	none	Troy Biosciences
beta-cyfluthrin	Tempo Ultra	pyrethroid	630-670	>5000	Bayer
bifenazate	Floramite	diphenyl	5000	>5000	Uniroyal
bifenthrin	Talstar	pyrethroid	375	>2000	FMC
carbaryl	Carbaryl, Sevimol, Sevin	carbamate	246	>4000	Aventis, Drexel, UAP, United Hort Supply
carbofuran	Furadan	carbamate	8	>3000	FMC
chlorpyrifos	Dursban, Pageant	organophosphate	270	2000	DowAgrosciences, TopPro, United Hort Supply
cryolite	Cryolite, Prokil, Kryocide	inorganic fluorine	practically nontoxic	practically nontoxic	Gowan, Cerexagri
cyfluthrin	Decathlon, Tempo	pyrethroid	826	>2000	Bayer, Olympic
cyromazine	Citation	trizine growth inhibitor	3387	>2000	Syngenta

Ornamentals: Information About Insecticides/Miticides (continued)

Pesticide (Common Name)	Trade Name(s)	Classification	Oral LD_{50}[1] (mg/kg)[2]	Dermal LD_{50}[1] (mg/kg)[2]	Manufacturer
deltamethrin	DeltaGard, Suspend	pyrethroid	128	>2000	Aventis, Bayer
dicofol	Docofol, Kelthane	chlorinated hydrocarbon	595	>5000	DowAgrosciences, Makhteshim-Agan, Gowan
dicrotophos	Bidrin, Inject-a-cide B	organophosphate	17	224	Mauget
diflubenzuron	Dimilin	insect growth regulator	>4640	>10,000	Uniroyal
endosulfan	Endocide, Phaser, Thiodan	chlorinated hydrocarbon	160	359	FMC
esfenvalerate	Asana XL	pyrethroid	458	>2000	DuPont
fenbutatin-oxide	Vendex	organo-tin	2630	>2000	Griffin
fenoxycarb	Precision	carbamate IGR	9220	>2000	Syngenta
fenpropathrin	Tame	pyrethroid	71-164	>2000	Valent
fluvalinate	Mavrik Aqua Flow	pyrethroid	282	20000	Wellmark
halofenozide	Mach 2	molting accelerator	2850	>2000	DowAgrosciences
hexythiazox	Hexygon	carboxamide	5000	>5000	Gowan
imidacloprid	Marathon, Merit	chloronicotinyl	450	>2000	Bayer, Olympic
iron phosphate	Sluggo	iron salt	>5000	>5000	Western Farm Service
lambda-cyhalothrin	Scimitar, Battle, Demand	pyrethroid	79	632	Syngenta, Lesco
malathion	Cythion, Malathion	organophosphate	1000	4100	UAP, Micro Flo, Agriliance, Gowan
metaldehyde	Deadline, Prozap	metacetaldehyde	360		Valent, Pace International, Amvac, UAP
metam-sodium	Vapam	carbamate	1891	>3000	Amvac

Ornamentals: Information About Insecticides/Miticides (continued)

Pesticide (Common Name)	Trade Name(s)	Classification	Oral LD_{50}[1] (mg/kg)[2]	Dermal LD_{50}[1] (mg/kg)[2]	Manufacturer
methiocarb	Grandslam, Mesurol	carbamate	20	>5000	Olympic, Gowan
methoxychlor	Marlate, Methoxychlor	chlorinated hydrocarbon	6000	>6000	Prentiss
naled	Dibrom	organophosphate	272	1100	Amvac
oxydemeton-methyl	Inject-a-cide, Harpoon	organophosphate	48	112	Gowan
oxythioquinox	Joust, Morestan	dithiocarbonate	1500	>2000	Bayer, Olympic
parathion	Parathion	organophosphate	2	50	Platte
permethrin	Ambush, Pounce, Astro	pyrethroid	4000	>4000	FMC, Agriliance, TopPro
petroleum oils	Dormant, Summer, Superior Oils, etc.	hydrocarbon oils	exempt	exempt	numerous
phosmet	Imidan	organophosphate	147	>4640	Gowan
propargite	Ornamite	sulfite ester	4029	2940	Uniroyal
pymetrozine	Endeavor	pyridine	>2000	>2000	Syngenta
pyrethrum	Pyrethrin, Pyrellin, Pyrenone, etc.	botanical	1500	1800	MGK, etc.
pyridaben	Sanmite	pyradazinole	820-1350	>2000	BASF
resmethrin	Resmethrin	pyrethroid	>2500	>3000	
soaps, pesticidal	Aphid-Mite Attack, Insecticidal Soap, M-Pede, etc.	fatty acid salts	practically nontoxic	practically nontoxic	
spinosad	Conserve	microbial	3783	>5000	DowAgrosciences
sulfur, elemental	Suffa	inorganic	>2000	>2000	Drexel
tralomethrin	Saga	pyrethroid	284	>2800	Bayer/Aventis
trichlorfon	Dylox	organophosphate	250	> 2100	Bayer

[1]Farm Chemicals Handbook '2000 (Meister Publishing Co., Willoughby, OH), and technical data information where available.
[2]Equals milligrams per kilogram of body weight applied orally or dermally. (1 milligram = 1/1,000 of a gram, 454 grams = 1 lb.)

Turf: Information About Insecticides/Miticides

Michael Boehm, Joseph Rimelspach, David Shetlar and John Street. 2003.
Management of Turfgrass Pests: Weeds, Diseases, and Insects,
The Ohio State University Extension Bulletin L-187.

Pesticide (Common Name)	Trade Name(s)	Classification	Oral LD_{50}[1] (mg/kg)[2]	Dermal LD_{50}[1] (mg/kg)[2]	Manufacturer
acephate	Orthene	organophosphate	980	10250	Valent, Micro Flo
azadirachtin (=neem, azatin)	Neem, Turplex	botanical	>5000	>2000	Gardens Alive
Bacillus thuringiensis	BT Bactospeine, Caterpillar Attack, Dipel, Javelin, Thuricide, Vectobac, others	spores + crystalline delta-endotoxin, microbial	none	none	Numerous- Valent, Biosciences Corp.
Beauveria bassiana	White fungus, *Beauveria* fungus	fungus	none	none	Troy Biosciences
beta-cyfluthrin	Tempo SC Ultra	pyrethroid	630-670	>5000	Bayer
bifenthrin	Talstar	pyrethroid	375	>2000	FMC, The Scotts Co.
carbaryl	Carbaryl, Sevin	carbamate	246	>4000	Bayer, Drexel, UAP
chlorpyrifos	Dursban, Pageant	organophosphate	270	2000	DowAgrosciences
clothianidan	Arena	neonicotinyl			Arvesta
cyfluthrin	Decathlon, Tempo	pyrethroid	826	>2000	Bayer, Olympic
deltamethrin	DeltaGard	pyrethroid	128	>2000	Bayer, Bonide
dicofol	Docofol, Kelthane	chlorinated hydrocarbon	595	>5000	DowAgrosciences, UAP
fipronil	Chipco Choice	phenyl pyrazol	97	>2000	Bayer
fluvalinate	Mavrik Aqua Flow	pyrethroid	282	>2000	Zoecon
halofenozide	MACH2	diacylhydrazine	2850	>2000	DowAgrosciences
imidacloprid	Merit	chloronicotinyl	450	>2000	Bayer, Olympic
imidacloprid + bifenthrin	Allectus	chloronicotinyl + pyrethroid	375	>2000	Bayer
lambda-cyhalothrin	Scimitar	pyrethroid	79	632	Syngenta
malathion	Cythion, Malathion	organophosphate	1000	4100	Drexel, UAP
metaldehyde	Bug-Geta, Deadline, Slug-Geta	metacetaldehyde	360		Valent, Pace International
permethrin	Astro, Ambush, Pounce	pyrethroid	450-4000	>4000	FMC, TopPro
spinosad	Conserve	microbial	>2000	>2000	DowAgrosciences
trichlorfon	Dylox, Proxol	organophosphate	250	>2100	Bayer

[1]Farm Chemicals Handbook '98 (Meister Publishing Co., Willoughby, OH), and technical data information where available.
[2]Equals milligrams per kilogram of body weight applied orally or dermally. (1 milligram = 1/1,000 of a gram, 454 grams = 1 lb.)

Pesticides for Home, Nursery, and Landscape: Updates 2006

Vera Krischik, Department of Entomology, University of Minnesota

Recently, several commonly used insecticides for the control of insects on woody landscape plants were removed from sale. EPA is phasing out the use of chlorinated hydrocarbons, organophosphates and carbamates due to safety concerns. Tree and shrub insecticides that have lost their registration include:

bendiocarb
chlorpyrifos, (only for nursery production, golf courses, and road medians)
diazinon
dimethoate
lindane

Always be sure that the pesticide label is for the LOCATION you are planning to treat. Use the product according to label directions and dispose of unused pesticides during local toxic waste collection days in your community.

Homeowner products should have the pest or a similar pest name on the container and come in ready to use sprays, dusts, or liquids that are sold at garden centers.

Landscape professional products are available at commercial supply houses for purchase by professionals with a valid pesticide license.

Pesticides for Trees and Shrubs in 2006

Common names of pesticides are followed in parenthesis by trade names for consumers and professionals (bold). This is not a complete list of brand names and inclusion or exclusion from this list does not constitute a claim about product effectiveness.

Aphids

abamectin (**Avid**)

acetamiprid (**Tristar**)

acephate (Isotox, **Orthene**)

azadirachtin (Safer's Brand Neem, **Azatin XL, Ornazin**)

bifenthrin (Ortho Home Defense, **Talstar**)

chlorpyrifos (**Chlorpyrifos Pro**)

clarified hydrophobic extract of neem (**Triact 70**)

clothianidin (**Celero**)

cyfluthrin (Bayer Advanced Garden Multi-Insect Killer, **Tempo**)

deltamethrin (Delta-Eight Enforcer, **Deltagard**)

dinotefuran (**Safari**)

esfenvalerate (Ortho Bug-B-Gone Multipurpose Spray)

fenpropathrin (**Tame**)

flonicamid (**Aria**)

fluvalinate (**Mavrik Aquaflow**)

imidacloprid (Bayer Advanced Tree & Shrub Insect Control, **Merit**)

insecticidal soap (Safer's, Concern)

lambda-cyhalothrin (**Scimitar, Battle**)

malathion (Ortho Malathion Plus Insect Spray Concentrate, **Malathion**)

oil, summer spray (**Whitmire's Ultrafine Spray Oil**)

permethrin (several products, **Astro**)

pymetrozine (**Endeavor**)

pyrethrin (several products)

pyridalyl (**Overture**)

pyriproxifen (**Distance**)

thiamethoxam (**Flagship**)

Borers and Bark Beetles (shothole, bronze birch borer, twolined chestnut borer, clearwing borers, flatheaded borers, roundedheaded borers)

bifenthrin (**Onyx, Talstar**) chlorpyrifos (**Chlorpyrifos Pro**) imidacloprid is not for clearwing borers (Bayer Advanced Tree & Shrub Control, **Merit**)	permethrin (several products, **Astro**)	

Caterpillars (cankerworms, Eastern tent, fall webworm, gypsy moth, spiny elm, white-market tussock moth)

acephate (Isotox, **Orthene, Acephate Pro**) acetamiprid (**Tristar**) azadirachtin (Safer's Brand Neem, **Azatin XL, Ornazin**) *Bacillus thuringiensis* var. *kurstaki* (**Thuricide, Dipel**) bifenthrin (Ortho Home Defense, **Onyx, Talstar**) carbaryl (**Sevin**) chlorfenapyr (**Pylon**) chlorpyrifos (**Chlorpyrifos Pro**) cyfluthrin (Bayer Advanced Garden Multi-Insect Killer, **Tempo**)	dinotefuran (**Safari**) deltamethrin (Delta-Eight, Enforcer, **Deltagard**) diflubenzuron (**Dimilin**) esfenvalerate (Ortho Bug-B-Gone Multipurpose Spray) fenpropathrin (**Tame**) fenoxycarb (**Precision**) fluvalinate (**Mavrik Aquaflow**) insecticidal soap (Safer's, Concern)	lambda-cyhalothrin (**Scimitar, Battle**) malathion (Ortho Malathion Plus Insect Spray Concentrate, **Malathion**) novaluron (**Pedestal**) permethrin (several products, **Astro**) pyridalyl (**Overture**) pyrethrin (several products) spinosad (Fertilome and Bulls-Eye BioInsecticide, **Conserve**) tebufenozide (**Confirm**) thiamethoxam (**Flagship**)

Galls (Cooley Spruce gall adelgid, Eastern spruce gall adelgid, others)

acephate (Isotox, **Orthene**) bifenthrin (Ortho Home Defense, **Talstar**) carbaryl (**Sevin**) chlorpyrifos (**Chlorpyrifos Pro**)	deltamethrin (Delta-Eight Enforcer, **Deltagard**) fluvalinate (**Mavrik Aquaflow**) imidacloprid (Bayer Advanced Tree & Shrub Insect Control, **Merit, Marathon**)	insecticidal soap (Safer's, Concern) lambda-cyhalothrin (**Scimitar, Battle**) oil, summer spray (**Whitmire's Ultrafine Spray Oil**) oil, dormant (Ortho, Fertilome)

Leaf feeding beetles (elm, cottonwood, spirea, viburnum, willow leaf beetles)

acephate (**Orthene**) acetamiprid (**Tristar**) azadirachtin (Safer's Brand Neem, **Azatin XL, Ornazin**) *Bacillus thuringiensis* var. *tenebrionis* (Bonide Colorado Potato Beetle Beater, **Novodor**) bifenthrin (Ortho Home Defense, **Onyx, Talstar)** carbaryl (**Sevin**)	chlorpyrifos (**Chlorpyrifos Pro**) clothianidin (**Celero**) cyfluthrin (Bayer Advanced Garden Multi-Insect Killer, **Tempo**) deltamethrin (Delta-Eight Enforcer, **Deltagard**) diflubenzuron (**Dimilin**) dinotefuran (**Safari**) esfenvalerate (Ortho Bug-B-Gone Multipurpose Spray) fluvalinate (**Mavrik Aquaflow**)	imidacloprid (Bayer Advanced Tree & Shrub Insect Control, **Merit**) lambda-cyhalothrin (**Scimitar, Battle**) malathion (Ortho Malathion Plus Insect Spray Concentrate, **Malathion**) permethrin (several products, **Astro**) spinosad (Fertilome and Bulls-Eye BioInsecticide, **Conserve**) thiamethoxam (**Flagship**)

Leaf feeding beetles (Japanese beetle adults)

acephate (Isotox, **Orthene**) acetamiprid (**Tristar**) azadirachtin (Safer's Brand Neem, **Azatin XL, Ornazin**) bifenthrin (Ortho Home Defense, **Talstar**) carbaryl (**Sevin***)* chlorpyrifos (**Chlorpyrifos Pro**) clothianidin (**Celero**)	cyfluthrin (Bayer Advanced Garden Multi-Insect Killer, **Tempo**) deltamethrin (Delta-Eight, Enforcer, **Deltagard**) diflubenzuron (**Dimilin**) dinotefuran (**Safari**) esfenvalerate (Ortho Bug-B-Gone Multipurpose Spray) fluvalinate (**Mavrik Aquaflow**)	imidacloprid (Bayer Advanced Tree & Shrub Insect Control, **Merit**) lambda-cyhalothrin (**Scimitar, Battle**) malathion (Ortho Malathion Plus Insect Spray Concentrate, **Malathion**) permethrin (several products, **Astro**) thiamethoxam (**Flagship**)

Leafhoppers, plant bugs, lace bugs (potato leafhopper, ash plant bug, honeylocust plant bug, lace bug)

acephate (Isotox, **Orthene**) acetamiprid (**Tristar**) azadirachtin (Safer's Brand Neem, **Azatin XL, Ornazin**) bifenthrin (Ortho Home Defense, **Onyx, Talstar**) buprofezin (**Talus**) carbaryl (**Sevin**) chlorpyrifos (**Chlorpyrifos Pro**)	clarified hydrophobic extract of neem (**Triact 70**) clothianidin (**Celero**) cyfluthrin (Bayer Advanced Garden Multi-Insect Killer, **Tempo**) deltamethrin (Delta-Eight, Enforcer, **Deltagard**) esfenvalerate (Ortho Bug-B-Gone Multipurpose Spray) fluvalinate (**Mavrik Aquaflow**)	imidacloprid (Bayer Advanced Tree & Shrub Insect Control, **Merit**) insecticidal soap (Safer's, Concern) lambda-cyhalothrin (**Scimitar, Battle**) malathion (Ortho Malathion Plus Insect Spray Concentrate, **Malathion**) permethrin (several products, **Astro**) pyrethrin (several products) thiamethoxam (**Flagship**)

Leafminers (arborvitae, birch, cherry-hawthorn, elm, oak, pine needle, spruce needle)		
abamectin (**Avid**) acephate (Isotox, **Orthene**) acetamiprid (**Tristar**) carbaryl (**Sevin**) chlorpyrifos (**Chlorpyrifos Pro**) cyromazine (**Citation**)	dinotefuran (**Safari**) fenoxycarb (**Precision**) imidacloprid – must apply early for systemic effect (Bayer Advanced Tree & Shrub Insect Control, **Merit, Marathon**) malathion (Ortho Malathion Plus Insect Spray Concentrate ornamentals, **Malathion**)	novaluron (**Pedestal**) permethrin (several products, **Astro**) spinosad (Fertilome, and Bulls-Eye BioInsecticide, **Conserve**) thiamethoxam (**Flagship**)
Mites (spider mites)		
abamectin (**Avid**) acequinocyl (**Shuttle**) bifenazate (**Floramite**) bifenthrin (Ortho Home Defense, **Onyx, Talstar**) chlorfenapyr (**Pylon**) clofentazine (**Ovation**) dicofol (**Kelthane**)	etoxazole (**TetraSan**) fenbutatin oxide (**Vendex**) fenpropathin (**Tame**) fenpyroximate (**Akari**) fluvalinate (**Mavrik Aquaflow**) hexythiazox (**Hexagon**) insecticidal soap (Safer's, Concern)	lambda-cyhalothrin (**Scimitar, Battle**) milbemectin (**Ultiflora**) pyridaben (**Sanmite**) oil, summer spray (**Whitmire's Ultrafine Spray Oil**) oil, dormant not effective on all mites (Ortho, Fertilome) **spiromesifen** (Judo, Forbid)
Mites (rust, eriophyid mites)		
abamectin (**Avid**) bifenthrin (Ortho Home Defense, **Talstar**) carbaryl (**Sevin**) chlorfenapyr (**Pylon**)	dicofol (**Kelthane**) fenbutatin oxide (**Vendex**) fenpyroximate (**Akari**) fluvalinate (**Mavrik Aquaflow**) insecticidal soap (Safer's, Concern)	lambda-cyhalothrin (**Scimitar, Battle**) oil, dormant is not effective on all mites (Ortho, Fertilome) pyridaben (**Sanmite**) spiromesifen (**Forbid, Judo**)

Sawflies (elm, pine, mountain-ash, pear slug, rose, slug, viburnum)

acephate (Isotox, **Orthene**)	diflubenzuron (**Dimilin**)	malathion (Ortho Malathion Plus Insect Spray Concentrate ornamentals, **Malathion**)
acetamiprid (**Tristar**)	dinotefuran (**Safari**)	oil, summer spray (**Whitmire's Ultrafine Spray Oil**)
azadirachtin (Safer's Brand Neem, **Azatin XL, Ornazin**)	esfenvalerate (Ortho Bug-B-Gone Multipurpose Spray)	permethrin (several products, **Astro**)
bifenthrin (Ortho Home Defense, **Onyx, Talstar**)	fluvalinate (**Mavrik Aquaflow**)	Pyrethrin (several products)
carbaryl (**Sevin**)	imidacloprid (Bayer Advanced Tree & Shrub Control, **Merit, Marathon**)	spinosad (Fertilome and Bulls-Eye BioInsecticide, **Conserve**)
cyfluthrin (Bayer Advanced Garden Multi-Insect Killer, **Tempo**)	insecticidal soap (Safer's, Concern)	thiamethoxam (**Flagship**)
chlorpyrifos (**Chlorpyrifos Pro**)	lambda-cyhalothrin (**Scimitar, Battle**)	tebufenozide (**Confirm**)
deltamethrin (Delta-Eight, Enforcer, **Deltagard**)		

Scales (armored scales, soft scales, mealybugs)

azadirachtin (Safer's Brand Neem, **Azatin XL, Ornazin**)	deltamethrin (Delta-Eight, Enforcer, **Deltagard**)	lambda-cyhalothrin (**Scimitar, Battle**)
acephate (Isotox, **Orthene**)	dinotefuran (**Safari**)	malathion (Ortho Malathion Plus Insect Spray Concentrate ornamentals, **Malathion**)
acetamiprid (**Tristar**)	esfenvalerate (Ortho Bug-B-Gone Multipurpose Spray	oil, summer spray (**Whitmire's Ultrafine Spray Oil**)
bifenthrin (Ortho Home Defense, **Onyx, Talstar**)	fluvalinate (**Mavrik Aquaflow**)	oil, dormant (Ortho, Fertilome)
buprofezin (**Talus**)	fenoxycarb (**Precision**), soft scales	permethrin (several products, **Astro**)
carbaryl (**Sevin**)	insecticidal soap (Safer's, Concern)	pyriproxifen (**Distance**), armored scales
chlorpyrifos (**Chlorpyrifos Pro**)	imidacloprid (Bayer Advanced Tree & Shrub Insect Control, **Merit**), not for armored scales	thiamethoxam (**Flagship**)
clarified hydrophobic extract of neem (**Triact 70**)		

Thrips (privet, daylily, western flower)

abamectin (**Avid**)	chlorfenapyr (**Pylon**)	**permethrin** (several products, **Astro**)
acephate (Isotox, **Orthene**)	dinotefuran (**Safari**)	pyridalyl (**Overture**)
acetamiprid (**Tristar**)	flonicamid (**Aria**)	spinosad (Fertilome and Bulls-Eye BioInsecticide, **Conserve**)
azadirachtin (Safer's Brand Neem, **Azatin XL, Ornazin**)	fluvalinate (**Mavrik Aquaflow**)	thiamethoxam (**Flagship**)
chlorpyrifos (**Chlorpyrifos Pro**)	novaluron (**Pedestal**)	

Pesticides for Turf: Updated 2006

Vera Krischik, Department of Entomology, University of Minnesota

Recently, several commonly used insecticides for the control of insects on landscape plants were removed from sale. EPA is phasing out the use of chlorinated hydrocarbons, organophosphates and carbamates due to safety concerns. Insecticides that have lost their registration include:

bendiocarb
chlorpyrifos, (only for nursery production, golf courses, and road medians)
diazinon
endosulfan

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Homeowner products should have the pest or a similar pest name on the container and come in ready to use sprays, dusts, liquids, or granular formations which are sold at garden centers.

Landscape professional products are available at commercial supply houses for purchase by professionals with a valid pesticide license.

Pest by feeding group	*Biorational pesticides*	*Conventional pesticides*
caterpillars: blade chewers		
armyworm, fall Treat at first signs of damage. Use a soap flush to detect larvae.	azadirachtin, halofenozide, nematodes *(Heterorhabditis bacteriophora, Steinernema carpocapsae)*, spinosad	beta-cyfluthrin, bifenthrin, carbaryl, chlorpyrifos, clothianidan, cyfluthrin, deltamethrin, lambda-cyhalothrin, permethrin
armyworm Treat at first signs of damage. Use a soap flush to detect larvae.	azadirachtin, *Bacillus thuringiensis* var. *kurstaki*, *Beauveria bassiana*, halofenozide, nematodes *(Heterorhabditis bacteriophora, Steinernema carpocapsae)*, spinosad	beta-cyfluthrin, bifenthrin, carbaryl, chlorpyrifos, clothianidan, cyfluthrin, deltamethrin, lambda-cyhalothrin, permethrin
cutworm Black and variegated cutworms are the most common pests on home lawns. Black cutworms and fall armyworms are common on golf courses. Treat when larvae are noticed. Light traps and pheromone traps can be used to monitor adult activity. Bronzed cutworms are spring and early summer pests. Best efficacy is achieved by spraying late in the day and not irrigating, but follow label directions for irrigation. Treat a first signs of damage. Use a soap flush to detect larvae.	azadirachtin, halofenozide, nematodes *(Heterorhabditis bacteriophora, Steinernema carpocapsae)*, spinosad	acephate, beta-cyfluthrin, bifenthrin, carbaryl, chlorpyrifos, clothianidan, cyfluthrin, deltamethrin, imidacloprid, (suppression only), lambda-cyhalothrin, trichlorfon

Pest by feeding group	Biorational pesticides	Conventional pesticides
sod webworms Treat when damage from larvae is noticed. Adult activity does not indicate damage from larvae will happen. Most damage occurs in spring and early summer though the adults are common in the fall. The cranberry girdler sod webworm should be treated in late August through September. Use a soap flush to detect larvae.	azadirachtin, *Bacillus thuringiensis* var. *kurstaki,* halofenozide, *Beauveria bassiana*, nematodes *(Heterorhabditis bacteriophora, Steinernema carpocapsae)*, spinosad	acephate, beta-cyfluthrin, bifenthrin, carbaryl, chlorpyrifos, clothianidan, cyfluthrin, deltamethrin, lambda-cyhalothrin, permethrin, trichlorfon
bluegrass billbug: blade chewer		
bluegrass billbug Control adults when first noticed migrating in April through May. Use pitfall traps to monitor adults or observe on warm, sunny days. Adults lay eggs in turf stems as soon as they become active. Control larvae in last week of May through first three weeks in June. Halofenozide and imidacloprid are not fast acting and are often used in areas that experienced high damage the previous year; apply from mid-May until early August. Thatch reduction and good irrigation improve efficacy of insecticides. Use resistant turfgrasses, endophyte enhanced perennial ryegrass, or tall fescue to reduce billbug populations.	*Beauveria bassiana*, halofenozide, nematodes *(Heterorhabditis bacteriophora, Steinernema carpocapsae)*	adults: beta-cyfluthrin, bifenthrin, chlorpyrifos, clothianidan, cyfluthrin, deltamethrin, lambda-cyhalothrin, thiamethoxam; larvae: carbaryl, chlorpyrifos, clothianidan, imidacloprid
suckers: blade suckers		
chinch bug Overwintering adults can be reduced from April to May for season-long control. Spring generation nymphs can be treated in mid-June. Summer generation nymphs can be treated in mid- to late August. Plant resistant turfgrasses, especially perennial ryegrass or turf-type tall fescue containing endophyte, reduce use of fine (red) fescue in sunny areas, reduce thatch. Treat at first signs of damage. Use a soap flush to detect larvae.	*Beauveria bassiana*, nematodes *(Heterorhabditis bacteriophora, Steinernema carpocapsae)*	acephate, beta-cyfluthrin, bifenthrin, carbaryl, chlorpyrifos, clothianidan, cyfluthrin, deltamethrin, imidacloprid (suppression only), lambda-cyhalothrin, permethrin
greenbug (aphids) Look for yellowing turf in June through August. Populations may persist into late fall. Treat a first signs of damage. Use a soap flush to detect larvae.	none	acephate, chlorpyrifos, clothianidan,
clover mite Damage appears as bleached turf in late fall and early spring. Treat when mites are active.	none	bifenthrin, chlorpyrifos, deltamethrin, dicofol, lambda-cyhalothrin, clothianidan
leafhopper Not a major pest of turf though large populations may be noted during the summer months. Considered a nuisance pest.	none	acephate, bifenthrin, carbaryl, chlorpyrifos, deltamethrin, clothianidan

Pest by feeding group	Biorational pesticides	Conventional pesticides
white grubs: root chewers Effective grub control requires accurate timing of applications to kill the most susceptible stage which is the small grubs. For most of the annual grubs (Japanese beetle, masked chafers, European chafer, Asiatic garden beetle and Oriental beetle), the best treatment time is July and early August. Halofenozide and imidacloprid are not fast acting and are often used in areas that experienced high damage the previous year; apply from mid May until early August. Only certain insecticides are effective for late season (September and October) or spring grub control, such as carbaryl, or trichlorfon for rescue treatments. If the product does not work, switch to another product. Reducing thatch and thorough irrigation after making a treatment will increase the chances of success.		
black turfgrass *Ataenius, Aphodius* beetle Adults may be controlled when either Horse Chestnut or Vanhoutte Spirea are in fullbloom, usually about mid May. Larvae should be treated in June.	*Beauveria bassiana*, halofenozide, spinosad	acephate, beta-cyfluthrin, bifenthrin, carbaryl, chlorpyrifos, clothianidan, cyfluthrin, imidacloprid, lambda-cyhalothrin, trichlorfon
Japanese beetle	*Beauveria bassiana,* halofenozide, nematodes *(Heterorhabditis bacteriophora, Steinernema carpocapsae)*	bifenthrin, beta-cyfluthrin, carbaryl, chlorpyrifos, clothianidan, cyfluthrin (JB adults only), deltamethrin (JB adults only), imidacloprid, lambda-cyhalothrin, permethrin, trichlorfon
May/June beetles, *Phyllophaga* spp. Some species have a three year life-cycle in northern areas.	halofenozide	carbaryl, clothianidan, deltamethrin, imidacloprid, lambda-cyhalothrin, trichlorfon
masked chafers	*Beauveria bassiana,* halofenozide, nematodes *(Heterorhabditis bacteriophora, Steinernema carpocapsae)*	bifenthrin, beta-cyfluthrin, carbaryl, chlorpyrifos, clothianidan, cyfluthrin, imidacloprid, lambda-cyhalothrin, permethrin, trichlorfon
green June beetle Larvae are most active after rains in late August through September. Irrigate before and after an application to keep the grubs near the surface. Larval control in the early spring is difficult to achieve.	*Beauveria bassiana*, halofenozide	carbaryl, clothianidan, trichlorfon
Oriental beetle	*Beauveria bassiana*, halofenozide, nematodes (*Heterorhabditis bacteriophora, Steinernema carpocapsae*)	beta-cyfluthrin, bifenthrin, carbaryl, chlorpyrifos, clothianidan, cyfluthrin, imidacloprid, lambda-cyhalothrin, permethrin, trichlorfon