

PESTICIDE SAFETY AND OTHER PESTICIDE INFORMATION (continued)

Applying the Pesticide

1. Calibrate your equipment regularly. Check for leaks, clogged nozzles, and excessive wear.
2. Wear the protective clothing indicated on the label.
3. Clear the area of other people and animals.
4. Avoid drift and runoff. Spray only when there is little or no wind. Do not spray when rain is imminent. Use the lowest spray pressure and largest nozzle orifices that are practical.
5. Be prepared for leaks, spills, or equipment failures.
6. Check the label to see what precautions are indicated. Post the area if required. Be sure that people entering the area during the re-entry interval are properly protected.

Cleaning Equipment

1. Thoroughly clean mixing, loading, and application equipment inside and out after each use.
2. Wear protective clothing while you are cleaning equipment or repairing it during use.
3. Clean equipment in an area where drainage will not endanger man or the environment.

Disposing of Excess Pesticides and Empty Containers*

1. Use excess pesticides according to label directions if possible. Otherwise follow label instructions for disposal.
2. Empty metal, plastic or glass containers should be pressure-rinsed or triple-rinsed. The rinse water should be directed into the spray tank. Properly rinsed containers can be placed in landfills or recycled. Contact your local extension office for recycling programs in your area.
3. Consult the label or your local extension office for other disposal information.

***See Waste Disposal under Pesticide Legislation and Regulations and telephone numbers under information numbers.**

PROTECT HONEY BEES FROM PESTICIDES

Keith S. Delaplane, Extension Entomologist

Many crops cannot be economically produced unless there are large numbers of honey bees to pollinate them. In addition, honey bees produce more than \$50 million of honey and beeswax annually, and honey bee pollination accounts for over \$14 billion added value to American agriculture each year. Beekeeping in Georgia adds an estimated \$70 million annually to our state's economy.

Many pesticides are extremely hazardous to honey bees. But damage can be minimized if the pesticide user and the beekeeper cooperate and take proper precautions.

The Pesticide User's Role

1. Use pesticides only when needed.
2. If possible, select one of the least hazardous pesticides from the following list, especially on flowering plants that attract bees.
3. Use the least hazardous method of application. Granules are usually harmless to honey bees. Sprays drift less than dusts and are less likely to kill bees in nearby areas. Whenever possible, minimize drift by applying pesticides with ground application equipment rather than with airplanes.
4. Do not apply pesticides when honey bees are active in the field. Applications in late evening or night are least likely to kill bees. Do not apply pesticides when plants are in flower unless it is absolutely necessary.
5. Avoid pesticide drift into apiaries or areas where crops or wild plants are flowering. With crops that require heavy pesticide applications, plant them in non-sensitive areas if possible.
6. Notify nearby beekeepers several days before you apply a pesticide.

The Beekeeper's Role

1. Whenever possible, locate colonies away from areas of heavy pesticide use.
2. Post your name, address, and phone number conspicuously at your apiary and tell nearby farmers where your hives are located.
3. Know which pesticides are commonly used in your area and be prepared to confine or remove your bees if you are notified that a pesticide will be applied. Commonly used pesticides are grouped according to hazard in the following list.

If you cannot move hives in time to avoid a pesticide application, you can cover each hive with a plastic sheet at night and in the early morning to confine the bees and protect them from short-residual pesticides. However, heat builds up rapidly once the plastic is exposed to the sun and it must be removed. An alternative - wet burlap, can be used for a day or more. This may be impractical for large numbers of hives. Colonies that are repeatedly exposed to pesticides in Groups I or II of the list below should be relocated.

Commonly Used Pesticides Grouped According To Their Relative Hazards To Honey Bees¹

Group I

Hazardous

abamectin (Agri-Mek)
acephate (Orthene, Address)
aminocarb (Matacil)
avemectin (AVID)
azinphosmethyl (Guthion)
benzene hexachloride (BHC)
bifenthrin (Capture)
carbaryl (Sevin, Sevin XLR-Plus)
carbofuran (Furadan)
chlordane
chlorpyrifos (Dursban, Lorsban)
chlorothoxyfos (Fortress)
clofentezine (Apollo)
crotoxyphos (Cyodrin)
cyfluthrin (Baythroid)
cyhalothrin (Warrior)
cypermethrin (Ammo)
deltamethrin (Decis)
diazinon (Diazinon, Spectracide)
dichlorvos (DDVP, Vapona)
dicrotophos (Bidrin)
dimethoate (Cygon, Dimethoate, Rebelate)
emamectin (Proclaim)
endosulfan (Thiodan)
EPN
esfenvalerate (Asana)
ethyl parathion (Parathion)
fenpropathrin (Danitol)
fenthion (Baytex)
fipronil

Group I (cont.)

Hazardous

heptachlor
hexythiazox (Savey)
imidacloprid (Provado)
imidan
indoxacarb (Avaunt)
lambda-cyhalothrin (Warrior)
lindane
malathion (Cythion, ULV)
methamidophos (Monitor)
methidathion (Supracide)
methiocarb (Mesuroil)
methomyl (Lannate)
methyl parathion (Pennacp-M)
mevinphos (Phosdrin)²
monocrotophos (Azodrin)
naled (Dibrom)²
oxamyl (Vydate >1 lb/A)
permethrin (Ambush, Pounce)
phorate (Thimet EC)
phosmet (Imidan)
phosphamidon (Dimecron)
propoxur (Baygon)
pyridaben (Pyramite)
resmethrin (Synthrin)
tebufenozide (Confirm)
TEPP²
thiamethoxam (Actara)
tralomethrin (Scout)
zeta-cypermethrin (Fury, Mustang)

Group II

Moderately Hazardous

aldicarb (Temik)
carbaryl (Sevin XLR formulation only)
carbophenothion (Trithion)
coumaphos (Co-Ral)
cypermethrin (Ammo)
cyromazine (Trigard)
DDT
diatomaceous earth (Diatect)
disulfoton (Di-Syston)
DSMA
emamectin benzoate (Proclaim)
endosulfan (Thiodan <0.5 lb/A)
endrin
ethoprop (Mocap)
fonofos (Dyfonate)
fundal (Galecron)
malathion (Cythion, ULV <3 fl oz/A)
methyl demeton (Metasystox)
mirex
MSMA
neem (Azatin, Neemix)
oxamyl (Vydate <0.5 lb/A)
oxydemeton-methyl (Metasystox R)
paraquat
perthane
phosalone (Zolone)
pymetrozine (Fulfill)
pyriproxyfen (Esteem)
ronnel (Co-Ral, Korlan)

spinosad (SpinTor)
temephos (Abate)
terbufos (Counter)
thiamethoxam (Actara, Platinum)
thiodicarb (Larvin)

Group III

Relatively Nonhazardous

acetamiprid (Assail)
allethrin (Pynamin)
amitraz (Mitac)
amitrole
azadirachtin (Align)
azoxystrobin (Abound)
Bacillus thuringiensis (Biobit, DiPel, Full-Bac, Javelin, MVP)³
Beauveria (Mycotrol)
benomyl (Benlate)
binapacryl (Morocide)
bordeaux mixture
bromoxynil
capsaicin (Hot Pepper Wax)
captan
carbaryl (Sevin G, Bait G)
carbofuran (Furadan G)
chloramben
chlorbenzide (Mitox)
chlorobenzilate (Acaraben)
chlorothalonil (Bravo)
copper compounds (Kocide)
copper oxychloride sulphate
copper 8-quinolinolate
copper sulfate (Monohydrated)

¹ List derived in part from Johansen, C.A. and Mayer, D.F. Pollination Protection. 1990, Wicwas Press; Bulletin E-53-W, Hunt, G.J., Purdue University; Environmental Entomology 33(5):1151-1154.

² Mevinphos (Phosdrin*), naled (Dibrom*), and TEPP have short residual activity and kill only the bees contacted at time of treatment or shortly thereafter. They are usually safe to use when bees are not in flight; they are not safe to use around colonies.

³ Not all *Bacillus thuringiensis* insecticides are safe for bees. The label for XenTari® (Valent BioSciences), with active ingredient *B. thuringiensis aizawai*, reads

"This product is highly toxic to honey bees exposed to direct treatment. Do not apply this product while bees are actively visiting the treatment area."

PROTECT HONEY BEES FROM PESTICIDES (continued)

Group III (cont.)

Relatively Nonhazardous

cryolite (Cryolite, Kryocide)
 cyromazine (Trigard)
 dalapon
 dazomet (Mylone)
 demeton (Systox)
 dexon
 diazinon (Diazinon G)
 dicamba (Banvel D)
 dichlone (Phygon)
 dicofol (Kelthane)
 difolatan
 diflubenzuron (Dimilin)
 dimite (DMC)
 dinocap (Karathane)
 diquat
 disulfoton (Di-Syston G)
 dodine (Cyprex)
 dyrene
 endothall
 EPTC (Eptam)
 ethion (Ethion)
 ethoprop (Mocap G)
 fenbutatin-oxide (Vendex)
 fenhexamid (Elevate)
 ferbam
 fluvalinate (Spur)
 folpet (Phaltan)
 Garlic Barrier
 genite 923
 glyodin (Glyoxide)
 kaolin (Surround)
 kepone
 malathion (Malathion G)
 mancozeb (Dithane M-45)

Group III (cont.)

Relatively Nonhazardous

maneb (Dithane M-22)
 MCPA
 metaldehyde (Metaldehyde Bait)
 methoxychlor (Marlate)
 metiram (Polyram) - F
 monuron (Telvar)
 myclobutanil (Rally)
 nabam (Parzate)
 nemagon
 nicotine sulfate
 oxythioquinox (Morestan)
 pentac
 propargite (Omite)
 pyrethrum (natural)
 pyrimidinamine (Vangard)
 rotenone (Rotenone)
 ryania
 silvex
 simazine (Princep)
 soap (M-Pede)
 sulfur
 tebufenozide (Confirm)
 TDE (Rhothane)
 tetradifon (Tedion)
 thioquinox (Eradex)
 thiram (Arasan)
 toxaphene
 trichlorfon (Dylox)
 trifloxystrobin (Flint)
 zineb (Dithane)
 ziram
 2,4-D
 2,4-DB
 2,4,5-T

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COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS

Dan Horton and John All, Entomologists

Always refer to the actual product label, which is the definitive guide for safe, legal pesticide use. This list is not comprehensive.

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
INSECTICIDES					
Bayer Advanced 12 Month Tree & Shrub Protect & Feed	imidacloprid	--	X	--	--
Bayer Advanced Carpenter Ant & Termite Killer Plus	b-cyfluthrin	X	X	--	--
Bayer Advanced Complete Insect Dust for Gardens	permethrin	X	--	X	X
Bayer Advanced Complete Insect Killer for Gardens R-T-U	carbaryl	--	X	X	X
Bayer Advanced Complete Insect Killer for Soil & Turf	imidacloprid + beta-cyfluthrin	--	X	--	--
Bayer Advanced Dual Action Rose & Flower Insect Killer R-T-U	imidacloprid + beta cyfluthrin	--	X	--	--
Bayer Advanced Fire Ant Killer	beta-cyfluthrin	--	X	--	--
Bayer Advanced Home Carpenter Ant and Termite Killer Plus	deltamethrin	X	X	--	--
Bayer Advanced Home Pest Control Indoor & Outdoor Insect	beta-cyfluthrin	X	X	--	--
Bayer Advanced Home Pest Plus Germ Killer	sodium o-phenylphenate + b-cyfluthrin	X	--	--	--
Bayer Advanced Power Force Carpenter Ant & Termite Killer Plus	deltamethrin	X	X	--	--
Bayer Advanced Rose & Flower Care 2 in 1 systemic	disulfoton	--	X	--	--
Bayer Advanced Season-Long Grub Control Ready-to-Spread Granules	imidacloprid	--	X	--	--
Bayer Advanced Termite Killer Ready-to-Spread Granules	imidacloprid	--	X	--	--
Bengal Roach Spray Aerosol	permethrin	X	--	--	--
Black Flag Fogging Insecticide	resmethrin	X	X	--	--
Bonide Borer-Miner Killer	permethrin	X	X	X	X
Bonide Citrus, Fruit & Nut Orchard Spray	sulfur + pyrethrins	X	X	X	X
Bonide Eight Vegetable, Fruit & Flower	permethrin	X	X	X	X
Bonide Eight Yard & Garden	permethrin	X	X	--	--
Bonide Systemic Granules	disulfoton	--	X	--	--
Bonide Systemic Rose and Flower Care	disulfoton (Disyston)	X	X	--	--
Combat Quick Kill Formula 1	fipronil	X	--	--	--
Cutter Bug Free Backyard One-Step Fogger	tetramethrin, piperonyl butoxide, permethrin	X	--	--	--
Cutter Bug Free Backyard Outdoor Fogger Aerosol	permethrin	--	X	--	--
Cutter Bug Free Backyard Spray Concentrate	permethrin	--	X	--	--

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Enforcer Flea Spray for homes	nylar + permethrin	X	--	--	--
Ferti-Lome Rose Food Cont Systemic Insecticide	disulfoton	--	X	--	--
Ferti-Lome Systemic Insecticide Granules	disulfoton	--	X	X	--
Garden Safe House Plant & Garden Insect Spray	pyrethrins + canola oil	X	X	X	X
Garden Safe Insect Killer Fruit & Vegetable	pyrethrin	X	X	X	X
Garden Safe Insect Killer Rose & Flower	pyrethrin	X	X	--	--
GardenTech Sevin Bug Killer	carbaryl	--	X	X	X
GardenTech Sevin-5 Dust	carbaryl	X	X	X	X
Green Light Borer Killer	permethrin	X	X	X	X
Green Light Conquest Insecticide Concentrate	permethrin	X	X	X	X
Green Light Fire Ant Dust	deltamethrin	X	X	--	--
Green Light Fruit Tree Spray	pyrethrins + piperonyl butoxide + hydrophobic extract of neem oil	--	--	--	X
Green Light Roach, Ant & Spider Control	deltamethrin	X	X	--	--
Hot Shot Flying Insect Aerosol	permethrin + d-trans allethrin	X	--	--	--
Hot Shot Fogger with Odor Neutralizer	tetramethrin + permethrin	X	--	--	--
Hot Shot Home Insect Control Clear Formula	lambda cyhalothrin	X	--	--	--
Hot Shot Kitchen Bug Killer Botanical (aerosol)	pyrethrins + piperonyl butoxide	X	--	--	--
Hot Shot MaxAttrax Roach Killing Powder with Boric Acid	orthoboric acid	X	--	--	--
Hot Shot No-Mess Fogger	tetramethrin + permethrin + piperonyl butoxide	X	--	--	--
Hot Shot No-Pest Strip Kills Flying & Crawling Insects	dichlorvos	X	--	--	--
Hot Shot Pest Control Concentrate	cypermethrin	X	--	--	--
Hot Shot Roach & Ant Killer (aerosol)	prallethrin + lambda- cyhalothrin	X	--	--	--
Hot Shot Spider Killer Water-based Non-staining	prallethrin + lambda- cyhalothrin	X	X	--	--
Hot Shot Ultra Ant & Roach Killer Aerosol	imiprothrin + lambda- cyhalothrin	X	--	--	--
No-Pest Ant & Roach Killer Aerosol	d-trans allethrin + lambda- cyhalothrin	X	--	--	--
No-Pest Home Insect Control	lambda-cyhalothrin	X	X	--	--
No-Pest Wasp & Hornet Killer aerosol	prallethrin + lambda cyhalothrin	X	X	--	--
Ortho Ant-B-Gon Dust	permethrin	X	X	X	X
Ortho Bug-B-Gon MAX Garden & Landscape Insect Killer	esfenvalerate	X	X	X	X
Ortho Bug-B-Gon MAX Garden Insect Dust	permethrin	X	--	X	X

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Ortho Bug-B-Gon MAX Insect Killer For Lawns Granules	bifenthrin	X	X	X	--
Ortho Bug-B-Gon MAX Lawn & Garden Insect Killer 1	bifenthrin	X	X	X	X
Ortho Bug-B-Gon Multi-Purpose Garden Dust 1	permethrin	X	X	X	X
Ortho Bug-B-Gon Multi-Purpose Insect Killer Ready-To-Use	esfenvalerate	X	X	X	X
Ortho Home Defense Max	bifenthrin	exterior barrier	X	--	--
Ortho Home Defense MAX Indoor & Outdoor Insect Killer 5	bifenthrin	X	X	--	--
Ortho Malathion Plus Insect Spray Concentrate	malathion	--	X	X	X
Ortho MAX Ant & Roach Killer Aerosol	dicarboxamide	X	--	--	--
Ortho MAX Fire Ant Killer Broadcast Granules	bifenthrin	--	X	--	--
Ortho MAX Flying Insect Killer Aerosol	tetramethrin + phenothrin	X	--	--	--
Ortho MAX Garden & Landscape Insect Killer	esfenvalerate	--	X	X	X
Ortho MAX Hornet & Wasp (aerosol) Killer	tetramethrin, sumithrin, cyclopropanecarboxylate	--	X	--	--
Ortho MAX Indoor Insect Fogger	pyrethrins + permethrin	X	--	--	--
Ortho MAX Lawn & Garden Insect Killer 1	bifenthrin	exterior	X	X	X
Ortho Orthene Fire Ant Killer	acephate	--	X	--	--
Ortho Ortho-Klor Termite and Carpenter Ant Killer	bifenthrin	X	X	--	--
Ortho Rose & Flower Insect Killer 1	bifenthrin	--	X	--	--
Ortho RTU Houseplant & Garden Insect Killer	bifenthrin	--	X	--	--
Ortho Volck Oil Spray	horticultural oil	--	X	--	X
Pointer Insecticide	imidacloprid	--	X	--	--
Pre-Strike Mosquito Torpedo	methoprene	exterior	X	--	--
Raid Ant & Roach Aerosol	imiprothrin + cypermethrin	X	--	--	--
Raid Concentrated Deep Roach Fogger	cypermethrin	X	--	--	--
Raid Flying Insect Aerosol	permethrin + tetramethrin _ d-trans allethrin	X	--	--	--
Raid Fumigator	permethrin	X	--	--	--
Raid Max 2-Way Roach Spray (aerosol)	imiprothrin + deltamethrin	X	--	--	--
Raid Max Concentrated Deep Roach Fogger	cypermethrin	X	--	--	--
Raid Wasp & Hornet (aerosol)	tetramethrin + permethrin	X	X	--	--
Raid Yard-Guard Mosquito Fogger	permethrin + d-cis/trans allethrin	--	X	--	--
Real Kill Ant & Roach Killer (aerosol)	d-trans allethrin + lambda-cyhalothrin	X	--	--	--
Real Kill Ant Killer ₂ Aerosol	d-trans allethrin + lambda-cyhalothrin	X	--	--	--

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Real Kill Flea Fogger Indoor	pyrethrins, piperonyl butoxide	X	--	--	--
Real Kill Home Insect Control Indoor & Outdoor	lambda-cyhalothrin	X	X	--	--
Real Kill Home Insect Control Indoor & Outdoor Insect Killer	cyfluthrin	X	--	--	--
Real Kill Indoor Fogger	cypermethrin	X	--	--	--
Schultz Houseplant & Garden Insect Spray	pyrethrin	X	X	X	X
Scotts Outdoor Defense Insect Killer	permethrin	--	X	--	--
Spectracide Ant Shield Home Barrier Granules	lambda-cyhalothrin	exterior barrier	X	--	--
Spectracide Ant Shield Home Barrier Insect Killer	permethrin	--	X	--	--
Spectracide Ant Shield Outdoor Killing Stakes	indoxacarb	--	X	--	--
Spectracide Bug Stop for Gardens	permethrin	--	X	X	X
Spectracide Bug Stop Indoor/Outdoor Home Insect Control	tralomethrin	X	X	--	--
Spectracide Commercial Wasp & Hornet Killer aerosol	tetramethrin + permethrin + piperonyl butoxide	X	--	--	--
Spectracide Fire Ant Killer Granules Mound Destroyer	lambda-cyhalothrin	--	X	--	--
Spectracide Fire Ant Killer Ready-to-Use Dust	permethrin	--	X	--	--
Spectracide Garden Insect Killer R-T-U	pyrethrins + piperonyl butoxide	--	X	X	X
Spectracide Malathion Insect Spray	malathion	X	X	X	X
Spectracide Pro Wasp & Hornet Killer	tetramethrin + permethrin + piperonyl butoxide	X	--	--	--
Spectracide Terminate Termite & Carpenter Ant Killer Concentrate	lambda cyhalothrin	X	X	--	--
Spectracide Terminate Termite & Carpenter Ant Killing Dust	disodium octaborate tetrahydrate	X	--	--	--
Spectracide Terminate Termite Detection & Killing Stakes	sulfuramid	--	X	--	--
Spectracide Terminate Termite Killing Foam aerosol	tralomethrin + d-trans allethrin	X	X	--	--
Spectracide Triazicide Brand Lawn & Garden Insect Killer	lambda-cyhalothrin	X	X	X	--
Spectracide Triazicide Once & Done! Insect Killer for Lawn & Landscape	lambda cyhalothrin	--	X	X	--
Spectracide Triazicide Once & Done! Insect Killer Granules	lambda-cyhalothrin	X	X	--	--
Spectracide Wasp & Hornet Killers aerosol	prallethrin + lambda cyhalothrin	X	X	--	--
SunSpray Ultra-Fine Pest Oil	refined horticultural oil	--	X	X	X
Terro Ant Killer Outdoor	permethrin	X	X	--	--
Terro Ant Killer Plus Outdoor Shaker Bag	lambda-cyhalothrin	--	X	--	--

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Terro Spider Killer Aerosol	pyrethrins + permethrin + piperonyl butoxide	X	--	--	--
Total Kill Lawn & Garden Insect Killer Concentrate	permethrin	X	X	X	X
Total Kill Lawn & Garden Insect Killer Granules	bifenthrin	X	X	X	--
Total Kill Wasp & Hornet Killer (aerosol)	tetramethrin & /trans phenothrin	X	--	--	--
Ultra-Kill Ant & Roach Killer (aerosol)	d-trans allethrin + lambda-cyhalothrin	X	X	--	--
Ultra-Kill Home Insect Killer	lambda-cyhalothrin	X	--	--	--
COMBINATION INSECTICIDE AND FUNGICIDE PRODUCTS					
Bayer Advanced All-in-One Rose and Flower Care concentrate	tebuconazole + imidacloprid	--	X	--	--
Bonide Fruit Tree Spray	captan + malathion + carbaryl	--	X	--	X
Bonide Insecticide-Miticide Fungicide	captan + malathion + carbaryl	--	X	--	X
Green Light Rose Defense II	neem + pyrethrin	--	X	X	X
Ortho Orthenex Garden Insect & Disease Control Concentrate	resmethrin + funginex + orthene	--	X	--	--
Spectracide Immunox Plus	permethrin + myclobutanil	--	X	--	--
COMBINATION INSECTICIDE, FUNGICIDE, AND MITICIDE PRODUCTS					
Bayer Advanced 3-in-1 Insect, Disease, & Mite Control	imidachloprid, tau-fluvalinate, tebuconazole	X	X	--	--
CONTACT MITICIDES					
Ortho Isotox Insect Killer Formula IV Concentrate	acephate + fenbutatin-oxide	--	X	--	--
SunSpray Ultra-Fine Pest Oil	refined horticultural oil	X	X	X	X
BAIT INSECTICIDES					
Amdro Ant Block Home Perimeter Ant Bait	hydramethylnon	--	X	--	--
Amdro Fire Ant Bait	hydramethylnon	--	X	--	--
Amdro Firestrike Fire Ant Bait	hydramethylnon	--	X	--	--
Combat Ant-Killing Gel	fipronil	X	--	--	--
Combat Platinum Brand Roach Killing Gel	fipronil	X	--	--	--
GardenTech Over'n Out Fire Ant Killer Granules	fipronil	--	X	--	--
GardenTech Over'n Out! Fire Ant Killer Mound Treatment	indoxacarb	--	X	--	--
Grant's Kills Ants Ant Stakes	arsenic trioxide	X	X	--	--
Hot Shot MaxAttrax Ant Bait Station	indoxacarb	X	--	--	--
Hot Shot MaxAttrax Ultra Brand Nest Destroyer Roach Bait Station	indoxacarb	X	--	--	--
Hot Shot Nest Destroyer Roach Bait Station	indoxacarb	X	--	--	--
Hot Shot Ultra Clear Roach Gel Bait	dinotefuran	X	--	--	--
Hot Shot Ultra Liquid Ant Bait Station	dinotefuran	X	--	--	--

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Hot Shot Ultra Liquid Roach Bait	dinotefuran	X	--	--	--
Logic	fenoxycarb	X	--	--	--
Ortho Ant-B-Gon Bait	propoxur	X	X	--	--
Raid Ant Baits III	avermectin B1	X	--	--	--
Raid Double Control Roach Baits	abamectin	X	--	--	--
Raid Max Double Control Large Roach Baits	avermectin B1	X	--	--	--
Raid Outdoor Ant Spikes	avermectin	X	X	X	X
Real-Kill Ant Bait	indoxacarb	X	--	--	--
Spectracide Fire Ant Killer Plus Preventer	pyriproxyfen	X	X	--	--
Spectracide Fire Ant Killer Plus Preventer Bait Once & Done!	indoxacarb	--	X	--	--
Terro Ant Killer Liquid Ant Baits	sodium tetraborate decahydrate (borax)	X	--	--	--
Terro Liquid Ant Baits Outdoor	borax	X	--	--	--
BAIT RODENTICIDES					
d-Con Mini Blocks Rodent Control Bait	difethialone	X	--	--	--
d-Con Mouse-Prufe II	brodifacoum 3	X	--	--	--
d-Con Ready Mixed Baitbits	brodifacoum	X	--	--	--
Enforcer Rat Bait	indandione	X	X	--	--
No-Pest Rat & Mouse All Weather Bait Bars	bromethalin	X	--	--	--
Real Kill Rat & Mouse Killer Weather Bars Bait	bromethalin	X	--	--	--
Sweeney's Kill Moles & Gophers Poison Peanuts Pellets	zinc phosphide	--	X	--	--
Sweeney's No Mess Mouse Paste Bait	difethialone	X	--	--	--
Tom Cat Vitamin D3 Mouse Poison Bait Trays	cholecalciferol	X	--	--	--
Tomcat Mole & Gopher Bait	zinc phosphide	--	X	--	--
Tomcat Mole Killer Worm Shaped Baits	bromethalin	--	X	--	--
Tomcat Ultra All-Weather Block Bait	brodifiolone	X	--	--	--
Tomcat Ultra Pelleted Bait (kills mice & rats)	brodifiolone	X	--	--	--
Victor Kills Mice! Mouse Bait Packs (pellets)	bromadiolone	X	--	--	--
VARMINT TRAPS					
d-Con Ultra Set Mouse Trap	trap	X	--	--	--
d-Con, No View, No Touch Mouse Trap	no toxin	X	--	--	--
Havahart Live Animal Cage Trap	non toxic	X	X	X	X
Real Kill Large Glue Traps for Rats & Mice	non toxin	X	--	--	--
Sweeney's Mole Trap	mechanical trap	--	X	--	--
Tomcat Glue Traps for Mice	adhesive trap	X	--	--	--
Tomcat Live Mouse Traps	live trap	X	--	--	--

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Tomcat Mouse Attractant Gel for Traps	non toxic	X	--	--	--
Tomcat Rat & Mouse Snap Traps	trap	X	--	--	--
Tomcat Wooden Mouse Traps	kill trap	X	--	--	--
Victor Electronic Mouse Trap	no toxin	X	--	--	--
Victor Mice Trap	no toxin	X	--	--	--
Victor Power Kill Rat Trap	no toxin	X	--	--	--
Victor Snap Mouse Trap	non toxic	X	--	--	--
INSECT TRAPS AND ATTRACTANTS					
Mosquito Magnet Trap Octenol Biting Insect Attractant	1-octen-3-ol, octenol	outdoor	X	--	--
Mosquito Octenol Lure	1-octen-3-ol	X	X	--	--
Nosquito 2 in 1 Power Bait	1-octen-3-ol + lactic acid	X	X	--	--
Raid Disposable Yellow Jacket Trap	plant-based attractant	X	X	--	--
Rescue Disposable Fly Trap	no toxin	X	X	--	--
Rescue Yellow Jacket Trap	attractant, no pesticide	X	X	X	X
Rescue Yellow Jacket Trap attractant & Trap	non-toxic	X	X	--	--
Stinger Bug Zapper Bulbs	UVB4S + UV40	X	X	--	--
Stinger Insect Killer	bug zapper	--	X	--	--
Tomcat Pest Glue Boards	adhesive trap	X	--	--	--
Victor Fly Catcher Sticky Roll	no toxin	X	--	--	--
INSECT REPELLENTS					
Cutter Backwoods Insect Repellent	deet	X	--	--	--
Cutter Lemon Eucalyptus Insect Repellent	oil of lemon + eucalyptus	X	--	--	--
Cutter Skinsations Insect Repellent	deet	X	--	--	--
Enoz Old Fashioned Moth Balls	naphthalene	X	--	--	--
Green Light Yard Safe Insect Repellent Granules	cedar oil	--	X	X	--
Off Deep Woods Spray	deet	X	--	--	--
Off Power Pad Lamp/Lantern	d-cis-trans allethrin	X	X	--	--
VARMINT REPELLENTS					
Black & Decker Electronic Pest Repellers	no toxin	X	--	--	--
Bonide Shot-Gun Repels-All Animal Repellent R-T-U	dried blood + putrescent whole egg solids + garlic oil	--	X	--	--
Cutter Advanced Light & Clean	picaridin	X	--	--	--
Dr. T's Nature Products Mole Out Mole Repelling Granules	castor oil	--	X	--	--
Dr. T's Nature Products Snake-A-Way snake Repelling Granules	naphthalene sulfur	X	X	--	--

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Exhart Gopher & Mole Mover	electronic deterrent	--	X	--	--
Havahart – Caring Control for Pets & Wildlife Get Away Granules	methyl nonyl ketone	--	X	--	--
Havahart Critter Ridder Granular	oil of black pepper + piperine + capsaicinoids	X	X	--	--
Havahart Critter Ridder Ready to Use Liquid	oil of black pepper + piperine + capsaicinoids	--	X	--	--
Havahart Deer Off	putrescent whole egg solids + capsaicinoids + garlic	--	X	X	X
Pestocator 2000 Plus Ultrasonic Rodent Repellent	no toxins	X	--	--	--
Spectracide Mole Stop Spray Concentrate	castor oil + soybean oil	--	X	X	X
Sweeney’s Mole & Gopher Repellent Lawn Protection	castor oil	--	X	--	--
Sweeney’s Solar Powered Sonic Spike (for moles, gophers)	sonic pulse	--	X	--	--
Terracycle Natural Ingredient Deer Repellent Spray	whole egg solids, peppermint oil, clove oil, cinnamon oil, white pepper	--	X	X	X
Victor Pest Chaser High Frequency Sound	non-toxic	X	--	--	--
Worryfree Outdoor Dog, Cat, & Bird Repellent Granules (organic)	white pepper, peppermint oil, thyme oil	--	X	X	X
FUNGICIDES					
Armicarb 100®	potassium bicarbonate	--	X	X	X
Banner Maxx	propiconazole	--	X	--	--
Bayer Advanced Fungus Control for Lawns	triadimefon	--	X	--	--
Bayer Advanced Garden Rose, Flowers & Shrubs Disease Concentrate	tebuconazole	--	X	--	--
Bonide Captan	captan		X	--	X
Ferti-Lome Halt Systemic Rose, Flower, Lawn, Ornamental Fungicide	thiophanate-methyl	--	X	--	X
Garden Tech Daconil Fungicide Ready-To-Use	chlorothalonil	--	X	X	X
Green Light Fung-Away Systemic Fungicide	bayleton	--	X	--	nuts
Green Light Fung-Away Systemic Lawn Fungicide	myclobutanil	--	X	--	--
Green Light Fung-Away Systemic Lawn Spray	bayleton	--	X	--	nuts
Green Light Powdery Mildew Killer	neem oil	--	X	X	--
Hi-Yield American Brand Copper Fungicide	copper hydroxide	--	X	X	X
Kaligreen Potassium Bicarbonate Soluble Powder	potassium bicarbonate	X	X	X	X
Monterey Aliette	aluminum tris (O-ethyl phosphonate)	--	X	--	--
Monterey E-rase RTU	jojoba oil	--	X	X	X

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Ortho Garden Disease Control	chlorothalonil	--	X	X	X
Ortho Rosepride Rose & Shrub Disease Control Concentrate	funginex	--	X	--	--
Remedy	potassium bicarbonate	--	X	X	X
Safer Flower, Fruit And Vegetable Garden Fung. RTU	sulfur	--	X	X	X
Scott's Lawn Fungus Control	thiophanate-methyl	--	X	--	--
Southern Ag Liquid Copper Fungicide	copper ammonium complex	--	X	--	--
Spectracide Immunox Lawn Disease Control	myclobutanil	--	X	--	--
BACTERICIDES					
Agri-mycin	streptomycin sulfate	--	X	X	X
Bonide Fire Blight Spray	streptomycin sulfate	--	X	--	X
Bonide Mancozeb Flowable with Zinc	mancozeb		X	X	X
Lime-sulfur	lime-sulfur	--	X	--	X
MOLLUSCICIDES (slugs and snails)					
Bayer Advanced Dual Action Snail & Slug Killer Bait	iron phosphate	--	X	X	X
Deadline Bug Bait	metaldehyde	--	X	X	--
Green Light Bug and Snail Bait	carbaryl + metaldehyde	X	X	X	X
Ortho Bug-Geta Snail & Slug Killer	metaldehyde	--	X	X	X
Sluggo	iron phosphate	X	X	X	X
HERBICIDES					
Balan	benefin		X	--	--
BASF Vantage	sethoxydim		X	X	X
Bayer Advanced All-in-One Weed Killer	MSMA + 2,4-D + MCPP + dicamba	--	X	--	--
Bayer Advanced Bermudagrass Control for Lawns R-T-U	fenoxyprop-p-ethyl	--	X	--	--
Bayer Advanced Power Force Brush Killer Plus	triclopyr	--	X	--	--
Bayer Advanced Southern Weed Killer for Lawn	2,4-D + MCPP + dicamba	--	X	--	--
Bonide Kleen Up Grass & Weed Killer	glyphosate + acifluorfen		X	--	--
Bonide Kleen Up Plus	glyphosate + oxyfluorfen	X	X	--	--
Bonide Total Vegetation Killer	prometon	X	--	--	--
Enforcer Brush Killer	triclopyr	X	--	--	--
Enforcer Next Day Grass & Weed Killer	diquat (or cacodylic acid, read label)		X	--	--
Enforcer Weed Shot Lawn Weed Killer	2,4-D + MCPP + dicamba		X		
Gallery	isoxaben		X	--	--
Garden Place Grass & Weed Killer	diquat + fluzifop		X	--	--

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Goal	oxyfluorfen		X	X	--
Green Light Amaze Grass & Weed Preventer	benefin + oryzalin	--	X	--	--
Green Light Bermuda grass Killer	fluazifop		X	--	--
Green Light Betasan 3.6 Granules	betasan	--	X	--	--
Green Light Com-Pleet	prometon	X	X	X	--
Green Light Com-Pleet Systemic Grass and Weed Killer	glyphosate		X	--	--
Green Light MSMA Crabgrass Killer 2	monosodium methanearsonate		X	--	--
Green Light Portrait Broadleaf Weed Preventer	isoxaben	--	X	--	--
Green Light Wipe-Out Broadleaf Weed Killer	2,4-D + MCPP + dicamba		X	--	--
Halts	pendimethalin		X	--	--
Hi-Yield Killzall	glyphosate		X	--	--
Image Kills Crabgrass with MSMA	MSMA	--	X	--	--
Image Kills Nutsedge	ammonium salt of imazaquin	--	X	--	--
Image Year-Long Vegetation Killer – kills grass & weeds	dichlobenil	exterior	--	--	--
LESCO Pre-M Plus	pendimethalin		X	--	--
Monsanto Manage	halosulfuron		X	--	nuts
Monsanto Roundup	glyphosate		X	X	X
Ortho Brush-B-Gon Poison Ivy Killer RTU	triclopyr	X	--	--	--
Ortho Grass-B-Gon Garden Grass Killer	fluazifop-p-butyl	--	X	--	--
Ortho Grass-B-Gon Grass Killer for Landscapes RTU	fluazifop	--	X	--	--
Ortho Ground Clear Vegetation Killer	glyphosate, imazapyr	exterior	X	--	--
Ortho Max Poison Ivy & Tough Brush Killer	triclopyr	--	X	--	--
Ortho Max Season-Long Weed & Grass Killer + Preventer	glyphosate + oxyfluorfen	exterior	X	X	X
Ortho Total Kill Lawn Weed Killer	dimethylamine salt of 2,4-D, dimethylamine salt of mecoprop-p, dimethylamine salt of dichlorprop-p	--	X	--	--
Ortho Weed-B-Gon Chickweed, Clover & Oxalis Killer	triclopyr		X	--	--
Ortho Weed-B-Gon Lawn Weed Killer 2 Concentrate	2,4-D + MCPP + dicamba		X	--	--
Ortho Weed-B-Gon Max Plus Crabgrass Control	quinclorac, mecoprop-p, 2,4-D, dicamba	--	X	--	--
Preen	trifluralin		X	X	X
Round Up Extended Control Weed & Grass Killer + Weed Preventer	glyphosate, imazapic, diquat dibromide	exterior	X	--	--
Round Up Poison Ivy & Tough Brush Killer Plus	glyphosate + triclopyr	exterior	X	--	--
Scotts Liquid Turf Builder with Plus 2 Weed Control	2,4-D	--	X	--	--

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Shoot Out Weed & Grass Killer	glyphosate + isopropylamine salt	--	X	--	--
Snapshot	triflan + isoxaben		X	--	--
Spectracide Brush Killer	2,4-D + MCPP + dicamba		X	--	--
Spectracide Systemic Grass & Weed Killer 2	diquat + fluazifop		X	--	--
Spectracide Total Vegetation Killer	prometon	X	--	--	--
Spectracide Triple Strike Grass, Weed, Root Killer	diquat dibromide, fluazifop-p-butyl, dicamba	exterior	X	--	--
Spectracide Weed & Grass Killer	diquat dibromide, fluazifop-p-butyl, dicamba, dimethylamine salt	exterior	X	--	--
Spectracide Weed Stop Weed Killer for Lawns	2,4-D + MCPP + dicamba		X	--	--
Sta-Green Phos-Free Crab-Ex Plus Crabgrass Preventer Plus Fert 30-0-5	dithiopyr		X	--	--
Sta-Green Weed & Feed R-T-U	2-4-D	--	X	--	--
Team	benefin + trifluralin		X	--	--
Total Kill by Ortho Weed & Grass Killer Ready To Use	glyphosate	paths	X	X	X
Ultra Kill Weed & Grass Killer	glyphosate	exterior	X	X	X
Vigoro Ultra Turf Lawn Weed Control	2,4-D + MCPP + dicamba		X	--	--
Vigoro Weed Stop Crabgrass & Weed Preventer	dithiopyr		X	--	--
XL2G	benefin + oryzalin		X	--	--
HERBICIDES (MOSS AND ALGAE CONTROL)					
Bayer Advanced 2-in-1 Moss & Algae Killer R-T-U	potassium soap of fatty acids	X	X	--	--
Lilly Miller Moss Out	ferrous sulfate	--	X	--	--
ORGANIC PESTICIDE PRODUCTS, ACTIVE INGREDIENT, AND USES					
ORGANIC INSECTICIDES					
Azadirachtin	leaf extracts from the neem tree	X	X	X	X
Bonide All Seasons Spray Oil – Horticultural & Dormant	petroleum Oil	X	X	X	X
Bonide Garden Dust	copper, rotenone	--	X	X	X
Diatomaceous earth	fossilized bodies of diatoms	X	X	X	X
Doom, Milky Spore Disease	<i>Bacillus popillae</i>	--	X	--	--
Ferti-Lome ‘Come and Get It’ Fire Ant Killer	spinosad	X	X	X	X
Ferti-Lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray	spinosad	--	X	X	X
Garden Safe Insect Killer Insecticidal Soap	potassium salts	X	X	X	X
Garden Safe Multi-Purpose Garden Insect Killer	pyrethrin + pyperonyl butoxide	X	X	X	--
Gardens Alive Bulls Eye Bioinsecticide	spinosad	--	X	X	X

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Gardens Alive Surround at Home Crop Protectant	kaolin clay	--	--	X	X
Green Light BT Worm Killer	<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>	--	X	X	X
Green Light Roach Powder	boric acid	X	--	--	--
Green Light Rose Defense	neem oil	--	X	X	X
Greenlight Home & Garden Insect Spray	thyme oil, clove oil, sesame oil	X	X	X	X
Mosquito Dunks, Mosquito Bits	<i>Bacillus thuringiensis</i> subspecies <i>israelensis</i>	X	--	--	--
Neem	oil extracted from neem tree nuts	--	X	X	X
Nematodes	nematodes that attack insects	--	X	X	X
Organocide Organic Insecticide & Fungicide	sesame oil	X	X	X	X
Pyrethrin products	chemical from chrysanthemum flowers	X	X	X	X
Safer Ant & Crawling Insect Killer	diatomaceous earth	X	X	X	X
Safer Ant & Roach Killer	D-limonene + pyrethrins + potassium salts of fatty acids	X	--	--	--
Safer Caterpillar Killer	<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>	--	X	X	--
Safer Fire Ant Bait R-T-U	spinosad	--	X	X	--
Safer Flying Insect Killer	d-limonene + pyrethrins + salts of fatty acids	X	--	--	--
Safer Insect Killing Soap	potassium salts of fatty acids	X	X	X	X
Safer Roach & ant Killing Powder	boric acid + German cockroach pheromone	X	--	--	--
Safer Tomato & Vegetable Insect Killer II	insecticidal soap + pyrethrin	--	X	X	X
Safer Wasp & Hornet Killer	D-limonene + pyrethrins + potassium salts of fatty acids	X	--	--	--
ORGANIC COMBINATION INSECTICIDES, FUNGICIDES AND MITICIDES					
Greenlight Neem Concentrate Insecticide, Fungicide, Miticide	clarified hydrophobic extract of neem oil	X	X	X	X
Safer 3-in-1 Garden Spray II - kills: fungus, mites, insects	potassium salts of fatty acids + sulfur	--	X	X	X
ORGANIC FUNGICIDES					
Bordeaux mixture	copper sulfate + lime + water	--	X	X	X
Concem Copper Soap Fungicide	copper octanoate	X	X	X	X
Copper	copper salts	--	X	X	X
Garden Safe Fungicide	neem oil	X	X	X	X
Garden sulfur	sulfur	--	--	X	X

COMMON PESTICIDE PRODUCTS AVAILABLE FOR HOMEOWNERS (continued)

PRODUCTS	ACTIVE INGREDIENT	INDOORS, PATIOS, DECKS, EXTERIOR HARDSCAPES & PATHS	FLOWERS, SHRUBS, TREES, LAWNS	VEGE- TABLES	FRUIT
Gardens Alive Serenade	<i>Bacillus subtilis</i> strain QST 713	X	X	X	X
Greenlight Blossom-End Rot Spray	calcium + chlorine	--	--	X	--
Lime-sulfur	calcium polysulfide	--	X	--	X
Odo Ban Germ Control Earth Choice Fungicide Virucide	silver + citric acid	X	--	--	--
Organocide Organic Insecticide & Fungicide	sesame oil	X	X	X	X
ORGANIC MOLLUSCICIDES					
Garden Safe Slug & Snail Bait	iron phosphate	--	X	X	X
Monterey Sluggo	iron phosphate	--	--	X	--
Worryfree Slug & Snail Bait	iron phosphate	--	X	X	X
ORGANIC HERBICIDES					
Concem Weed Prevention Plus	corn gluten meal	--	X	X	--
Garden Safe Weed & Grass Killer	ammoniated soap of fatty acids	exterior	X	--	--
Nature's Glory Weed & Grass Killer	acetic acid	X	--	--	--
St. Gabriel Laboratories Bumout	clove oil	X	X	--	--
St. Gabriel Laboratories Premerge	corn gluten meal	--	X	--	--

NAMES, CLASSIFICATION AND TOXICITY OF PESTICIDES

Paul Guillebeau, Extension Entomologist

The tables on the following pages of this section will help you to identify specific pesticide active ingredients and give you an indication of their toxicities.

NAMES. The chemical names of pesticide active ingredients are usually so long and complex that they are generally used only in the active ingredient statement on the pesticide label and in scientific or technical publications. The common name of a pesticide active ingredient is one that is commonly used and has usually been approved by an appropriate scientific group. The trade name of a pesticide active ingredient is a copyrighted name used by its producer. A pesticide active ingredient will usually have only one common name but it may have several trade names. For example, glyphosphate is the common name for the chemical name isopropylamine salt of N-(phosphonomethyl) glycine, the active ingredient in Roundup. The trade names listed in the tables are capitalized and bear an asterisk(*). These trade names should not be confused with the brand names used by formulators and distributors of pesticide products.

CLASSIFICATION. Insecticides, herbicides, fungicides and other pesticides are primarily classified on the basis of their chemical structure or origin. The inorganic pesticides are those which contain no carbon in their chemical structure. The organic pesticides, those that contain carbon, are usually synthetic but some are obtained from natural sources such as plants or microorganisms. Some synthetic organic pesticides such as the pyrethroids, or synthetic pyrethrins, are based on naturally occurring chemicals.

TOXICITY. The Environmental Protection Agency uses the results of acute toxicity studies on test animals, usually rats and rabbits, to place pesticides in toxicity categories (I-IV) which determine what signal word must appear on the label. Although inhalation toxicity, eye corrosiveness and skin corrosiveness studies are also used, results of acute dermal and acute oral toxicity studies are more publicized and usually more important.

The below table shows the signal words that must appear on the pesticide label for each toxicity category and the range of the oral and dermal median lethal doses (LD₅₀) for each category. A pesticide that falls into category I only because of eye or skin corrosiveness must bear "Danger" but not "Poison" nor the skull and crossbones symbol on its label.

The LD₅₀ is the dose of a substance at which one-half of the exposed test animals are killed. It is based on the body weight of the animal and is expressed in milligrams of the substance per kilogram of animal (mg/kg). One mg./kg. is equivalent to 1 ppm. The lower the LD₅₀, the greater the toxicity. Although most LD₅₀ values that are readily available in publications are for the pesticide active ingredient or actual toxicant, the signal word on each pesticide product is determined by the toxicity of that particular formulation. Formulated pesticides are usually, but not necessarily, less toxic than the active ingredient. The toxicity categories given in the following tables are based solely on the accompanying LD₅₀ values which, unless stated otherwise, are for the active ingredient. EPA would not necessarily assign the same category shown in the tables.

TOXICITY CATEGORY	SIGNAL WORDS REQUIRED ON LABEL BY EPA	ORAL LD ₅₀ (MG./KG.)	DERMAL LD ₅₀ (M.G./K.G.) 24-HR. EXPOSURE	ORAL DOSAGE TO KILL AN ADULT*
I. Highly Toxic	DANGER, POISON, Plus Skull & Crossbones symbol	0 to 50	0 to 200	A few drops to 1 tsp.
II. Moderately Toxic	WARNING	50 to 500	200 to 2,000	1 tsp. to 2 Tbsp.
III. Slightly Toxic	CAUTION	500 to 5,000	2,000 to 20,000	1 oz. to 1 pt. (1 lb.)
IV. Low Toxicity	CAUTION	>5,000	>20,000	1 pt. (1 lb.) or more

Toxicity categories and signal words on the pesticide label are based on acute toxicity studies, but sub-acute and chronic toxicity studies are also conducted. Acute toxicity involves the short-term response of the test animal to a single large exposure to the pesticide. Sub-acute toxicity refers to the response of the animal to repeated or continuous exposure to smaller doses over less than one-half of its normal life span. In chronic toxicity studies exposures are repeated or continued for longer than one-half of the animal's life span.

*Less for child/pet

You should not keep or use pesticides with the words DANGER-POISON on the label. Contact Paul Guillebeau 706-542-2816 (bugman@uga.edu) for information about disposal.

PESTICIDE RATE AND DOSAGE CALCULATIONS

Paul Guillebeau, Extension Entomologist

How to Calculate Pesticide Dilutions and Dosages For Large Areas

Pesticides for use in sprays are generally available as wettable or soluble powders and as liquid concentrates. These must be diluted, usually with water, before use. Other diluents, such as deodorized kerosene, may be used for special applications.

The precise amount of water applied to an acre (or other given area) is immaterial as long as it falls within a recommended range, delivers the recommended amount of pesticide, provides adequate coverage, and does not result in excessive runoff or drift. If you know the area (acres, sq. ft., etc.) or units (trees, cows, etc.) covered by a given amount of spray you can determine the dosage or rate of active ingredient each receives by adding the proper quantity of pesticide to that amount of water. Dusts and granules are applied without dilution by the user. Therefore the amount applied per acre or unit is much more critical because you have no other way of controlling the dosage or rate of active ingredient.

The amount of active ingredient in liquid concentrates is expressed in pounds per gallon. In granules, dusts, wettable or soluble powders, and other solids it is nearly always expressed as percent by weight. Application rates are usually expressed as amount of pesticide product but sometimes they may be expressed as pounds of active ingredient or actual toxicant. Actual toxicant and active ingredient are practically synonymous.

1. To find the pounds of wettable powder (WP), dust (D) or granules (G) per acre to obtain the desired pounds of active ingredient (a.i.) per acre:

$$\text{lbs. of WP, D or G per acre} = \frac{\text{lbs. a.i. desired} \times 100}{\% \text{ a.i. in WP, D, or G}}$$

2. To find the pints of liquid concentrate per acre to obtain the desired pounds of active ingredient (a.i.) per acre: pints of liq.

$$\text{conc. per acre} = \frac{\text{lbs. a.i. desired} \times 8^*}{\text{lbs. a.i. per gallon of liq. conc.}}$$

*If you want the answer in gallons, quarts, or fluid ounces substitute 1, 4, or 128 respectively for 8.

3. To find the amount of wettable powder (WP) or liquid concentrate to use in a given amount of spray:

amt. of WP or liq conc. = no. of acres treated with amount of spray X desired amount of WP or liq. conc. per acre*

*Trees, animal, etc. can be substituted for acres.

4. To find the pounds of wettable powder needed to obtain a desired percentage of active ingredient in water:

$$\text{lbs. of WP} = \frac{\text{gals. of spray desired} \times \% \text{ a.i. desired} \times 8.3^{**}}{\% \text{ a.i. in WP}}$$

5. To find the gallons of liquid concentrate needed to obtain a desired percentage of active ingredient in water:

$$\text{gal. of liq. conc.} = \frac{\text{gals. of spray desired} \times \% \text{ a.i. desired} \times 8.3^{**}}{\text{lbs. a.i. per gal. of liq. conc.} \times 100}$$

**One gallon of water weighs approximately 8.3 pounds. If another diluent is used the weight per gallon of the other diluent should be substituted for 8.3.

PESTICIDE RATE AND DOSAGE CALCULATIONS (continued)

Pesticide Conversion Table for Large Areas

LIQUID FORMULATIONS

Amount of Commercial Product to Add to Spray Tank for Each Acre Treated

FORMULATION LBS./GAL. ACTIVE INGREDIENT	Desired Rate Per Acre if Active Ingredient, Lbs.															
	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1	1.1	1.5	2	2.5	3	4	6	9
1.5	10 oz	17 oz	26 oz	34 oz	43 oz	51 oz	64 oz	85 oz	96 oz	128 oz	171 oz	213 oz	256 oz	341 oz	512 oz	768 oz
2	8 oz	13 oz	19 oz	26 oz	32 oz	38 oz	48 oz	64 oz	72 oz	96 oz	128 oz	160 oz	192 oz	256 oz	384 oz	576 oz
3	5 oz	9 oz	13 oz	17 oz	21 oz	26 oz	32 oz	43 oz	48 oz	64 oz	85 oz	107 oz	128 oz	171 oz	256 oz	384 oz
4	4 oz	6 oz	10 oz	13 oz	16 oz	19 oz	24 oz	32 oz	36 oz	48 oz	64 oz	80 oz	96 oz	128 oz	192 oz	288 oz
6	2.6 oz	4.3 oz	6.4 oz	9 oz	11 oz	13 oz	16 oz	21 oz	24 oz	32 oz	43 oz	53 oz	64 oz	85 oz	128 oz	192 oz
6.7	2.3 oz	3.8 oz	5.7 oz	7.6 oz	9.6 oz	11.5 oz	14.3 oz	19.1 oz	21 oz	29 oz	38 oz	48 oz	57 oz	76 oz	115 oz	172 oz
7	2.2 oz	3.7 oz	5.5 oz	7.3 oz	9.1 oz	11 oz	13.7 oz	18 oz	20 oz	27 oz	37 oz	46 oz	55 oz	73 oz	110 oz	165 oz
8	2 oz	3.2 oz	4.8 oz	6.4 oz	8 oz	9.6 oz	12 oz	16 oz	18 oz	24 oz	32 oz	40 oz	48 oz	64 oz	96 oz	144 oz

WETTABLE POWDER FORMULATIONS

Pounds of Commercial Product to Add to Spray Tank for Each Acre Treated

FORMULATION LBS./GAL. ACTIVE INGREDIENT	Desired Rate Per Acre if Active Ingredient, Lbs.																
	0.2	0.3	0.4	0.5	0.6	0.8	0.8	1	1	2	2	3	3	4	5	8	10
50	0.4	0.6	0.8	1	1.2	1.5	1.6	2	2	3	4	5	6	8	10	16	20
75	0.3	0.4	0.5	0.7	0.8	1	1.1	1.3	2	2	3	3	4	5.3	6.6	10.7	13.33
80	0.3	0.4	0.5	0.6	0.8	0.9	1	1.2	2	2	3	3	4	5	6.2	10	12.5

GRANULES AND DUSTS

Pounds of Commercial Product to Apply Per Acre

FORMULATION LBS./GAL. ACTIVE INGREDIENT	Desired Rate Per Acre if Active Ingredient, Lbs.					
	1	2	3	4	5	10
2.5	40	80	120	160	200	400
5	20	40	60	80	100	200
10	10	20	30	40	50	100
15	6.6	13.3	20	26.6	33.3	66.6
20	5	10	15	20	25	50

PESTICIDE RATE AND DOSAGE CALCULATIONS (continued)

Converting Large Volume Recommendations to Small Volumes or Areas

Frequently, pesticide recommendations are given only for large volume applications, i.e., amount per 100 gallons or per acre, but only a small amount is needed. Conversion of liquids to smaller quantities is relatively easy and precise because suitable equipment such as measuring spoons are readily available. Scales sensitive enough to handle small quantities of solid materials are not widely available and it is often more practical to use volumetric measures. Various conversion tables have been prepared on the premise that there are 200 to 300 teaspoons (roughly 2 to 3 pints) per pound of solid pesticide product. These tables are grossly inaccurate because of the wide variation in bulk density among solid pesticide formulations. For instance, a pint of almost any insecticide wettable powder will weigh much less than a pint of fungicide that has a high metal content. Greater accuracy can be obtained if one first determines the weight of a given volume of the solid material and then calculates the volumetric measure. This will usually provide acceptable accuracy but it is still not as accurate as actually weighing a solid formulation. When coupled with a little simple and obvious arithmetic the following formulas will enable you to convert large volume recommendations to smaller quantities.

1. To find the amount of liquid concentrate per gallon when label recommendations are given in pints per 100 gallons:

$$\text{teaspoons/gallon} = \text{recommended pints per 100 gallons}$$

or

$$\text{milliliters/gallon} = \text{recommended pints per 100 gallons} \times 4.73^*$$

2. To find the amount of wettable powder (WP) or other solid formulation per gallon when label recommendations are given as pounds per 100 gallons:

$$\text{teaspoons/gallon} = \text{recommended lbs./100 gals.} \times \text{cupful in 1 lb. of formulation} \times 0.053^*$$

or

$$\text{teaspoons/gallon} = \text{recommended lbs./100 gals.} \times \text{Tbs. in 1 ounce of formulation} \times 0.53^*$$

or

$$\text{grams/gallon} = \text{recommended lbs./100 gals} \times 4.54^*$$

3. To find the amount of liquid concentrate to apply per 1,000 square feet when label recommendations are given as pints per acre:

$$\text{teaspoons/1,000 sq. ft.} = \text{recommended pints/acre} \times 2.20^*$$

or

$$\text{milliliters/1,000 sq. ft.} = \text{recommended pints/acre} \times 10.9^*$$

4. To find the amount of dust (D), granules (G) or wettable powder (WP) to apply per 1,000 square feet when label recommendations are given as pounds per acre:

$$\text{lbs./1,000 sq. ft.} = \text{recommended lbs./acre} \times 0.023^*$$

or

$$\text{Tbs/1,000 sq. ft.} = \text{recommended lbs./acre} \times \text{cupful in 1 lb. of formulation} \times 0.37^*$$

or

$$\text{Tbs/1,000 sq. ft.} = \text{recommended lbs./acre} \times \text{Tbs. in 1 lb. of formulation} \times 0.023^*$$

or

$$\text{grams/1,000 sq. ft.} = \text{recommended lbs./acre} \times 10.4^*$$

*These values have been rounded off to facilitate calculations.

Conversion Tables for Small Areas

LIQUID FORMULATIONS¹

Amount of Commercial Product to Add to Spray Tank to Treat 1000 Sq. Ft.

FORMULATION LBS./GAL. ACTIVE INGREDIENT	Desired Rate Per Acre if Active Ingredient, Lbs.							
	0.25	0.5	1	2	4	8	10	12
0.5	3 Tbs ¹ (43.4) ³	3 oz ² (86.8)	6 oz (173.7)	11 oz 1 Tbs (347.4)				
1	1 Tbs 1 tsp (21.7)	3 Tbs (43.4)	3 oz (86.8)	5 oz 1 Tbs (173.7)				
2	2 tsp (10.8)	1 Tbs 1 tsp (21.7)	3 Tbs (43.4)	3 oz (86.8)	5 oz 1 Tbs (173.7)	11 oz 1 Tbs (342.4)		
4	1 tsp (5.4)	2 tsp (10.8)	1 Tbs 1 tsp (21.7)	3 Tbs (43.4)	3 oz (86.8)	6 oz (173.7)	7 oz 2 tsp (217.1)	8 oz 4 tsp (260.6)

¹ approximate values

² refers to level measure

³ figure in parentheses refers to milliliters

CALIBRATION METHOD FOR HYDRAULIC BOOM AND BAND SPRAYERS, AND OTHER LIQUID APPLICATORS

Paul E. Sumner, Extension Engineer

The procedure below is based on spraying 1/128 of an acre per nozzle or row spacing and collecting the spray that would be released during the time it takes to spray the area. Because there are 128 ounces of liquid in 1 gallon, this convenient relationship result in ounces of liquid caught being directly equal to the application rate in gallons per acre.

Calibrate with clean water when applying toxic pesticides mixed with large volumes of water. Check uniformity of nozzle output across the boom. Collect from each for a known time period. Each nozzle should be within 10 percent of the average output. Replace with new nozzles if necessary. When applying materials that are appreciably different from water in weight or flow characteristics, such as fertilizer solutions, etc., calibrate with the material to be applied. Exercise extreme care and use protective equipment when active ingredient is involved.

Step 1. Determine type of application to be made and select appropriate procedure from Table 1. Example - Herbicide Broadcast - Procedure A.

Table 1. Corresponding procedures for different spray applications.

Type of Application	Procedure	Coverage Basis
	Herbicide, Insecticide, Nematicide, Fungicide, or Liquid Fertilizer	
Broadcast	A	Broadcast (gal/acre)
Band	B	Broadcast (gal/acre of band)
Row (See note)	C (Use this procedure when rates are given for row treatment)	Row (gal/acre of row)

Note: Determine and use average row spacing for modified row patterns. Use width of area covered per row as row spacing in skip row patterns.

Step 2. Using procedure A, B, or C below as selected in Step 1, determine appropriate calibration distance from Table 2.

- (A) Broadcast Application: Outlets or nozzles must be evenly spaced. Measure outlet (nozzle, etc.) spacing. Find this spacing in left column of Table 2 and read the corresponding calibration distance. Example - for a 19" spacing the distance would be 214.9 feet.
- (B) Band Application: Measure band width. Find this band width in the left column of Table 2 and read the corresponding calibration distance. Example - for a 12" band, the distance would be 340.3.
- (C) Row Application: Measure row spacing for evenly spaced rows. Find this row spacing in the left column of Table 2 and read the corresponding calibration distance from the column on the right. Example - for a 38" row spacing, the distance would be 107.5 feet. (See note above for modified and skip rows.)

CAUTION: AGRICULTURAL CHEMICALS CAN BE DANGEROUS. IMPROPER SELECTION OR USE CAN SERIOUSLY INJURE PERSONS, ANIMALS, PLANTS, SOIL, OR OTHER PROPERTY. BE SAFE: SELECT THE RIGHT CHEMICAL FOR THE JOB. HANDLE IT WITH CARE. FOLLOW THE INSTRUCTIONS ON THE CONTAINER LABEL AND INSTRUCTIONS FROM THE EQUIPMENT MANUFACTURER.

Step 3. Measure and mark calibration distance in a typical portion of the field to be sprayed.

Step 4. With all attachments in operation (harrows, planters, etc.) and traveling at the desired operating speed, determine the number of seconds it takes to travel calibration distance. Be sure machinery is traveling at full operating speed the full length of the calibration distance. Mark or make note of engine RPM and gear. Machine must be operated at same speed for calibration.

Step 5. With sprayer sitting still and operating at same throttle setting or engine R.P.M. as used in Step 4, adjust pressure to the desired setting. Machine must be operated at same pressure used for calibration.

Step 6. For procedure (A) Step 2, broadcast application, collect spray from one nozzle or outlet for the number of seconds required to travel the calibration distance.

For procedure (B) Step 2, band application, collect spray from all nozzles or outlets used on one band width for the number of seconds required to travel the calibration distance.

For procedure (C) Step 2, row application, collect spray from all outlets (nozzles, etc.) used for one row for the number of seconds required to travel the calibration distance.

**CALIBRATION METHOD FOR HYDRAULIC BOOM AND BAND SPRAYERS,
AND OTHER LIQUID APPLICATORS (continued)**

Table 2. Calibration distances with corresponding widths.

Row Spacing, Outlet Spacing or Band Width (Whichever Applies) (Inches)	Calibration Distance (feet)
48**	85.1
46	88.8
44	92.8
42	97.2
40	102.1
38	107.5
36	113.4
32	127.6
30	136.1
24	170.2
20	204.2
19	214.9
18	226.9
14	291.7
12	340.3
10	408.4
8	510.5

To determine distance for spacing or band width not listed, divide the spacing or band width expressed in feet into 340.3. Example: for a 13" band the calibration distance would be 340 divided by 13/12 = 314.1.

** To increase calibration accuracy for a wide nozzle spacing, multiply calibration distance by a factor (for example, 2); then, divide the fluid amount collected by the same factor for GPA. For narrow nozzle spacings with long calibration distances, divide calibration distance by a factor (for example, 4); then, multiply the fluid amount collected by the same factor for GPA.

Step 7. Measure the amount of liquid collected in fluid ounces. The number of ounces collected is the gallons per acre rate on the coverage basis indicated in Table 1. For example, if you collect 18 ounces, the sprayer will apply 18 gallons per acre. Adjust applicator speed, pressure, nozzle size, etc. to obtain recommended rate. If speed is adjusted, start at Step 4 and recalibrate. If pressure or nozzles are changed, start at Step 5 and recalibrate.

Step 8. To determine amount of pesticide to put into a sprayer or applicator tank, divide the total number of gallons of mixture to be made (tank capacity for a full tank) by the gallons per acre rate from Step 7 and use recommended amount of pesticide for this number of acres.

Band Application

Use the recommended **broadcast** pesticide rates to make tank mixtures for band applications when calibrating with procedure (B) of this method. The number of gallons/acre determined in Step 7 is the gallons that will be applied to each acre of actually treated band.

To determine the gallons of spray mixture required to make a band application on a field, the number of acres that will be in the actually treated band must be determined. When all treated bands are the same width and all untreated bands are the same width, which is usually the case, the acres in the actually treated band can be calculated by placing the width of the treated band over the sum of the widths of the treated band and the untreated band, and multiplying this fraction times the number of acres in the field. Example - How many acres will actually be treated in a 30 acre field if a 12" band of chemical is applied over the drill of rows spaced 36" apart. The treated band width is 12". The untreated band width is (36" - 12") = 24". Acres actually treated will be 12" divided by (12" + 24") times 30 acres equals 10 acres. The amount of mixture required will be 10 times the number of gallons per acre from Step 7. The amount of chemical required will be 10 times the recommended broadcast rate for one acre.

Check rate recommendations carefully as to type of application, broadcast, band or row, and type of material specified, formulated product, active ingredient, etc.

Calculating Formulation Requirements For Active Ingredient Rates.

To determine amount of liquid pesticide required for a rate given in pounds of active ingredient per acre, divide recommended rate by pounds active ingredient per gallon stated on label. Example - Pesticide label states 4 lbs. active ingredient per gallon and recommends 1/2 pound active ingredient per acre. Amount of pesticide required: 1/2 lb./A divided by 4 lb./gal. = 1/8 gal./A.

To determine amount of wettable powder required for a rate given in pounds active ingredient per acre, divide recommended rate by percent active ingredient stated on label. Example - Pesticide label states powder is 50% active ingredient. Two pounds of active ingredient is recommended per acre. Amount of pesticide powder required: 2 lbs. AI/A divided by 0.5 AI/lb. = 4 lbs./A.

CALIBRATION METHOD FOR BOOMLESS BROADCAST SPRAYERS

Paul E. Sumner, Extension Engineer

All sprayers should be calibrated often to ensure that pesticide is being applied at the correct rate. Most broadcast applications are made with a boom arrangement where the nozzle tips are spaced evenly along the boom. However, in some situations this may be impossible or undesirable, so a cluster nozzle or a single nozzle with a wide spray pattern may be used.

Calibrate with clean water when applying toxic pesticides mixed with large volumes of water. When applying materials that are appreciably different from water in weight or flow characteristics, such as fertilizer solutions, etc., calibrate with the material to be applied. Exercise extreme care and use protective equipment when active ingredient is involved.

The following instructions outline a simple method to calibrate a boomless broadcast sprayer.

- Step 1.** Determine spray width. The spray width is the distance between successive passes through a field. This is usually given in the manufacturers' literature for a specific nozzle. If you are unable to find this in the catalogs, use 80 to 85 percent of the wetted spray width.
- Step 2.** Using the spray width in Step 1, determine the calibration distance from Table 1.
- Step 3.** Measure and mark calibration distance on typical terrain to be sprayed.
- Step 4.** With all attachments in operation and traveling at the desired operating speed, determine the number of seconds it takes to travel the calibration distance. Be sure machinery is traveling at full operating speed the full length of the calibration distance. Mark or make note of engine RPM and gear. Machine must be operated at same speed for calibration.
- Step 5.** With sprayer sitting still and operating at same throttle setting or engine R.P.M. as used in Step 4, adjust pressure to the desired setting. Machine must be operated at same pressure used for calibration.
- Step 6.** Collect spray from all nozzles or outlets for the number of seconds required to travel the calibration distance.

Table 1. Calibration distances with corresponding widths.

Swath Width (feet)	Calibration Distance (feet)
40	85.1
38	89.5
36	94.5
32	106.3
30	113.4
28	121.5
24	141.8
20	170.2
18	189
16	212.7
12	283.6
10	340.3
8	425

To determine distance for swath width not listed, divide the swath width expressed in feet into 340.3 and multiply by 10. Example: for 13 feet swath the calibration distance would be 340.3 divided by 13 multiplied by 10 = 261.8.

- Step 7.** Measure the amount of liquid collected in fluid ounces.
- Step 8.** Divide the total number of fluid ounces by 10 to obtain gallons per acre applied. For example, if you collect 180 ounces, the sprayer will apply 18 gallons per acre. Adjust applicator speed, pressure, nozzle size, etc. to obtain recommended rate. If speed is adjusted, start at Step 3 and recalibrate. If pressure or nozzles are changed, start at Step 5 and recalibrate.
- Step 9.** To determine amount of pesticide to put into a sprayer or applicator tank, divide the total number of gallons of mixture to be made (tank capacity for a full tank) by the gallons per acre rate from Step 8 and use recommended amount of pesticide for this number of acres.

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CALIBRATION METHOD FOR GRANULAR APPLICATIONS

Paul E. Sumner, Extension Engineer

Applicators used in granular applications should be calibrated to insure uniformity and accuracy of the application. A more accurate and uniform application can reduce the quantity of an active ingredient required for a given degree of control, which benefits the environment as well as the producer.

Several factors influence the amount of granular material applied to a given area. Granular material is usually metered with an adjustable orifice. The amount of material that flows through the orifice per revolution relies on orifice opening size and may rely on rotor speed. A wide variation in product characteristics, such as size, density, and shape, requires that a calibration be made for every chemical applied. Also changes in climatic conditions, such as temperature and humidity, can result in a different flow rate.

CAUTION: Calibration is done using the chemical to be applied. Protective equipment, such as rubber gloves, etc. should be used to avoid contact with the chemicals to be applied.

Granular application is usually done in combination with another operation, such as planting or cultivating. The applicator may be ground driven or driven with a small electric motor. The following procedure will give the pounds (total weight) of material applied per acre broadcast or row basis as indicated. A weight scale incremented in ounces is required for this procedure.

Step 1. Determine type of application to be made and select appropriate procedure from Table 1. Example - Broadcast - Procedure A.

Table 1. Corresponding procedures for different spray applications.

Type of Application	Procedure	Coverage Basis (Volume of Application)
Broadcast	A	Broadcast (lbs/acre)
Band	B	Broadcast (lbs/acre of band)
Row (See note)	C (Use this procedure when rates are given for row treatment)	Row (lbs/acre of row)

Note: Determine and use average row spacing for modified row patterns. Use width of area covered per row as row spacing in skip row patterns for broadcast rates

Step 2. Using procedure A, B, or C below as selected in Step 1, determine appropriate calibration distance from Table 2.

- (A) Broadcast Application: Outlets must be evenly spaced. Measure outlet spacing. Find this spacing in left column of Table 2 and read the corresponding calibration distance. Example - for a 19" spacing the distance would be 214.9 feet.
- (B) Band Application: Measure band width. Find this band width in the left column of Table 2 and read the corresponding calibration distance. Example - for a 12" band, the distance would be 340.3.
- (C) Row Application: Measure row spacing for evenly spaced rows. Find this row spacing in the left column of Table 2 and read the corresponding calibration distance from the column on the right. Example - for a 38" row spacing, the distance would be 107.5 feet.

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Step 3. Measure and mark calibration distance in a typical portion of the field to be applied.

Step 4. With all attachments in operation (harrows, planters, etc.) and traveling at the desired operating speed, determine the number of seconds it takes to travel calibration distance. Be sure machinery is traveling at full operating speed the full length of the calibration distance. Mark or make note of engine RPM and gear. Machine must be operated at same speed for calibration.

Step 5. **Multiply the number seconds required to travel calibration distance by 8.** This is the number of seconds to collect.

Step 6. With applicator sitting still and operating at same speed as used in Step 4, adjust gate openings to desired setting. Check uniformity of outlets across the swath or rows. Collect from each outlet for a known time period. Each outlet should be within 5 percent of the average outlet output.

CALIBRATION METHODS FOR GRANULAR APPLICATIONS (continued)

Table 2. Calibration distances with corresponding widths.

Row Spacing, Outlet Spacing or Band Width (Whichever Applies) (Inches)	Calibration Distance (feet)
48*	85.1
46	88.8
44	92.8
42	97.2
40	102.1
38	107.5
36	113.4
32	127.6
30	136.1
24	170.2
20	204.2
19	214.9
18	226.9
14	291.7
12	340.3
10	408.4
8	510.5

To determine distance for spacing or band width not listed, divide the spacing or band width expressed in feet into 340.3. Example: for a 13" band the calibration distance would be 340 divided by 13/12 = 314.1.

* To increase calibration accuracy for a wide outlet spacing, multiply calibration distance by a factor (for example, 2); then, divide Step 8 material collected by the same factor for pounds per acre. For narrow spacings with long calibration distances, divide calibration distance by a factor (for example, 4); then, multiply Step 8 by the same factor for pounds per acre. Keep in mind that application accuracy will decrease when factoring narrow outlet or band spacings.

Step 7.**For procedure (A), Step 2, broadcast application, collect from one outlet for the number of seconds indicated in Step 5.

For procedure (B), Step 2, band application, collect from all outlets used on one band width for the number of seconds indicated in Step 5.

For procedure (C), Step 2, row application, collect from all outlets used for one row for the number of seconds indicated in Step 5.

**** For ground driven equipment, multiply the calibration distance by 8 and collect from each outlet while traveling the calibration distance.**

Step 8. Weigh the amount of material collected in ounces. The number of ounces collected is the pounds per acre rate on the coverage basis indicated in Table 1. For example, if you collect 18 ounces using procedure (A) or (B), the applicator will apply 18 pounds per acre on a broadcast coverage basis. Adjust applicator speed, gate opening, etc. to obtain recommended rate.

Step 9. Applicators should be checked for proper calibration every 4-8 hours of use. Simply repeat steps 7 and 8. If there is a difference of more than 5 percent of original calibration, check the system.

Band Application

To determine the pounds of material required to make a band application on a field, the number of acres that will be in the actual treated band must be determined. When all treated bands are the same width and all untreated bands are the same width, which is usually the case, the acres in the actual treated band can be calculated by placing the width of the treated band over the sum of the widths of the treated band and the untreated band, and multiplying this fraction times the number of acres in the field. Example - How many acres will actually be treated in a 30 acre field if a 12" band of chemical is applied over the drill of rows spaced 36" apart. The treated band width is 12 inches. The untreated band width is (36" - 12") = 24". Acres actually treated will be 12 inches divided by (12" + 24") times 30 acres equals 10 acres. The amount of material required for the 30 acre field will be 10 times the number of pounds per acre from Step 8.

Check rate recommendations carefully as to type of application, broadcast, band or row, and type of material specified, formulated product, active ingredient, etc.

CALIBRATION OF BACKPACK SPRAYERS 1000 Ft² Method

Paul E. Sumner, Extension Engineer

Backpack sprayers are often used to treat ornamental or small areas of turf. Herbicide recommendations are based amount per acre and amount per 1000 ft². Regardless of the type of sprayer used to apply herbicides, the speed, pressure and nozzle height must be kept constant for accurate application. The backpack sprayer may require some modification so that it is better suited for application. A pressure gauge mounted on the tank side of the shutoff valve will allow continuous monitoring of the tank pressure, which must remain uniform. Optimum pressure control can be achieved by inserting a pressure regulator between the pressure gauge and nozzle. To prevent dripping after the shutoff valve is closed, use a quick, positive pressure shutoff valve or a strainer with a check valve. Nozzle clogging, a problem associated with the use of wetttable powders (as well as DF and WDG formulations) can be reduced by inserting a 50 mesh in-line strainer and keeping the solution constantly agitated. The following is a procedure of 1000 ft².

Step 1. Measure the length and width of the test area to be sprayed. Then calculate the area to be covered.

Test Area is: length _____ ft X width _____ ft = _____ ft²

Step 2. Fill sprayer with water and spray the test area. Record the amount of water to refill the sprayer.

Volume (ounces) per test area _____

Step 3. Find the label rate of material to be applied per 1000 ft².

Rate _____ per 1000 ft²

Step 4.

$$\frac{1000 \text{ ft}^2 \times \text{ounces per test area}}{\text{Test Area (ft}^2\text{)}} = \text{Volume (ounces) per 1000 ft}^2$$

Step 5. Calculate the area covered per tank as follows:

$$\frac{\text{Tank volume (ounces)} \times 1000 \text{ ft}^2}{\text{Volume per 1000 ft}^2} = \text{Area covered per tank (ft}^2\text{)}$$

Step 6. Calculate amount of material to add to tank.

$$\frac{\text{Area per tank (ft}^2\text{)} \times \text{rate per 1000 ft}^2}{1000} = \text{Amount to add (rate units)}$$

Solutions derived from the above may need to be converted to a smaller unit in order to accurately measure the pesticide accurately. The following conversion will help simplify this problem.

Conversions:

Volume

gallon x 128	= fluid ounces (fl oz)
pints x 16	= fluid ounces (fl oz)
fl oz x 29.57	= milliliters (ml)
gallon x 4	= quarts (qts)
quarts x 2	= pints (pts)
fl oz x 2	= Tablespoons (tbs)
tsp x 3	= Tablespoons (tbs)
tsp x 5	= milliliters (ml)

Weight

pounds x 16	= weight ounces (wt oz)
wt. ounces x 28.35	= grams (g)
grams x 1000	= milligrams (mg)

CALIBRATING TURFGRASS SPRAYERS (Gallons per 1000 sq ft)

Paul E. Sumner, Extension Engineer

Low-pressure boom sprayers are used frequently for applying chemicals on large areas such as golf courses and recreational areas. Application rates for turf are normally given in gallons per 1000 sq ft. Calibrating a boom sprayer is not as difficult as it sounds. Calibrate your sprayer often to compensate for nozzle wear, pump wear and speed changes.

Calibrate with clean water. Check uniformity of nozzle output across the boom. Collect from each for a known time period. Each nozzle should be within 10 percent of the average output. Replace with new nozzles if necessary. When applying materials that are appreciably different from water in weight or flow characteristics, such as fertilizer solutions, etc., calibrate with the material to be applied. Exercise extreme care and use protective equipment when active ingredient is involved.

Step 1. Determine the Effective Swath Width (W) per Nozzle

For boom spraying, the effective spray width of each nozzle (W) is equal to the distance in inches between two nozzles.

Step 2: Determine Travel Speed (MPH)

To determine the travel speed, measure a known distance. Use fence posts or flags to identify this distance. A distance over 200 feet and a tank at least half full are recommended. Travel the distance determined at your normal spraying speed and record the elapsed time in seconds. Repeat this step and take the average of the two measurements. Use the following equation to determine the travel speed in miles per hour:

$$\text{Travel Speed (MPH)} = \frac{\text{Distance (feet)} \times 0.68}{\text{Time (seconds)}}$$

(0.68 is a constant to convert feet/second to miles/hour)

Step 3. Determine Nozzle Flow Rate (GPM)

With the sprayer parked, operate the sprayer at the same pressure level and catch the output from each nozzle in a measuring jar for one minute (or collect output for half a minute and then double the ounces collected) to determine the nozzle flow rate in ounces per minute (OPM) Then, convert the final average output in OPM to gallons per minute (GPM) using the following equation:

$$\text{GPM} = \text{OPM}/128 \text{ (1 Gallon} = 128 \text{ ounces)}$$

Step 4. Determine the Actual Application Rate in Gallons per Gal/1000 sq ft

Use the following equation to determine the gallons per acre application rate:

$$\text{Gallons per 1000 ft}^2 = \frac{136 \times \text{gpm (per nozzle)}}{\text{MPH} \times W}$$

GPM: average nozzle flow rate in gallons per minute

MPH: travel speed in miles per hour

W: distance between two nozzles in inches

136 a constant to convert units to gallons/1000²

Step 5. Calculate the area covered per tank as follows:

$$\frac{\text{Tank Volume (gallons)} \times 1000}{\text{Application Rate (gallons per 1000 ft}^2)} = \text{Area covered per tank (ft}^2)$$

Step 6. Calculate amount of material to add to tank.

$$\frac{\text{Area covered per tank (ft}^2) \times \text{Material rate per 1000 ft}^2}{1000} = \text{Amount to add (rate units)}$$

HAND SPRAYER CALIBRATION FOR ORNAMENTAL AND TURF

Paul E. Sumner, Extension Engineer

Hand sprayers are often used to treat ornamental or small areas of turf. The directions on many ornamental pesticide product labels say to "spray until foliage is wet" or perhaps "spray until runoff." Unfortunately, these directions are subject to each applicator's interpretation of what "wet" or "runoff" is.

Recommendations are based on amount per 100 gallons. This is the dilution ratio for the chemical applied. Use the following to convert 100 gallon rate to bed area rate.

1. Measure the length and width of the area to be sprayed. Then calculate the area to be covered.

Bed Area is: length _____ X width _____ = _____ ft²

2. Fill sprayer with water and spray the area. Record the amount of water to refill the sprayer.

Gallons per bed area _____

3. Obtain the rate of material to be applied per 100 gallons.

Rate _____

- 4.

$$\frac{\text{Rate} \times \text{Gallons per bed area}}{100} = \text{Amount per bed area}$$

5. Calculate the total amount of material to be used for the application (total bed area) as follows:

$$\frac{\text{Amount per bed area} \times \text{Area to be sprayed}}{\text{Bed area (ft}^2\text{)}} = \text{Amount of material}$$

6. Total solution to prepare is:

$$\frac{\text{Gallons per bed area} \times \text{Area to be sprayed (ft}^2\text{)}}{\text{Bed area (ft}^2\text{)}} = \text{Total Solution}$$

Solutions derived from the above may need to be converted to a smaller unit in order to accurately measure the pesticide. Refer to the conversion section to help simplify this problem.

Conversions:

Volume

pints x 16 = fluid ounces (fl oz)
fl oz x 29.57 = milliliters (ml)
gallon x 4 = quarts (qts)
quarts x 2 = pints (pts)
fl oz x 2 = Tablespoons (tbs)
tsp x 3 = Tablespoons (tbs)
tsp x 5 = milliliters (ml)

Weight

pounds x 16 = weight ounces (wt oz)
wt. ounces x 28.35 = grams (g)
grams x 1000 = milligrams (mg)

ATTENTION!
PESTICIDE PRECAUTIONS

1. Observe all directions, restrictions and precautions on pesticide labels. It is dangerous, wasteful and illegal to do otherwise.
2. Store all pesticides in original containers with labels intact and behind locked doors. "KEEP PESTICIDES OUT OF THE REACH OF CHILDREN."
3. Use pesticides correct label dosages and intervals to avoid illegal residues or injury to plants and animals.
4. Apply pesticides carefully to avoid drift or contamination of non-target areas.
5. Surplus pesticides and containers should be disposed of in accordance with label instructions so that contamination of water and other hazards will not result.
6. Follow directions on the pesticide label regarding restrictions as required by State and Federal Laws and Regulations.
7. Avoid any action that may threaten an Endangered Species or its habitat. Your county extension agent can inform you of Endangered Species in your area, help you identify them, and through the Fish and Wildlife Service Field Office identify actions that may threaten Endangered Species or their habit.