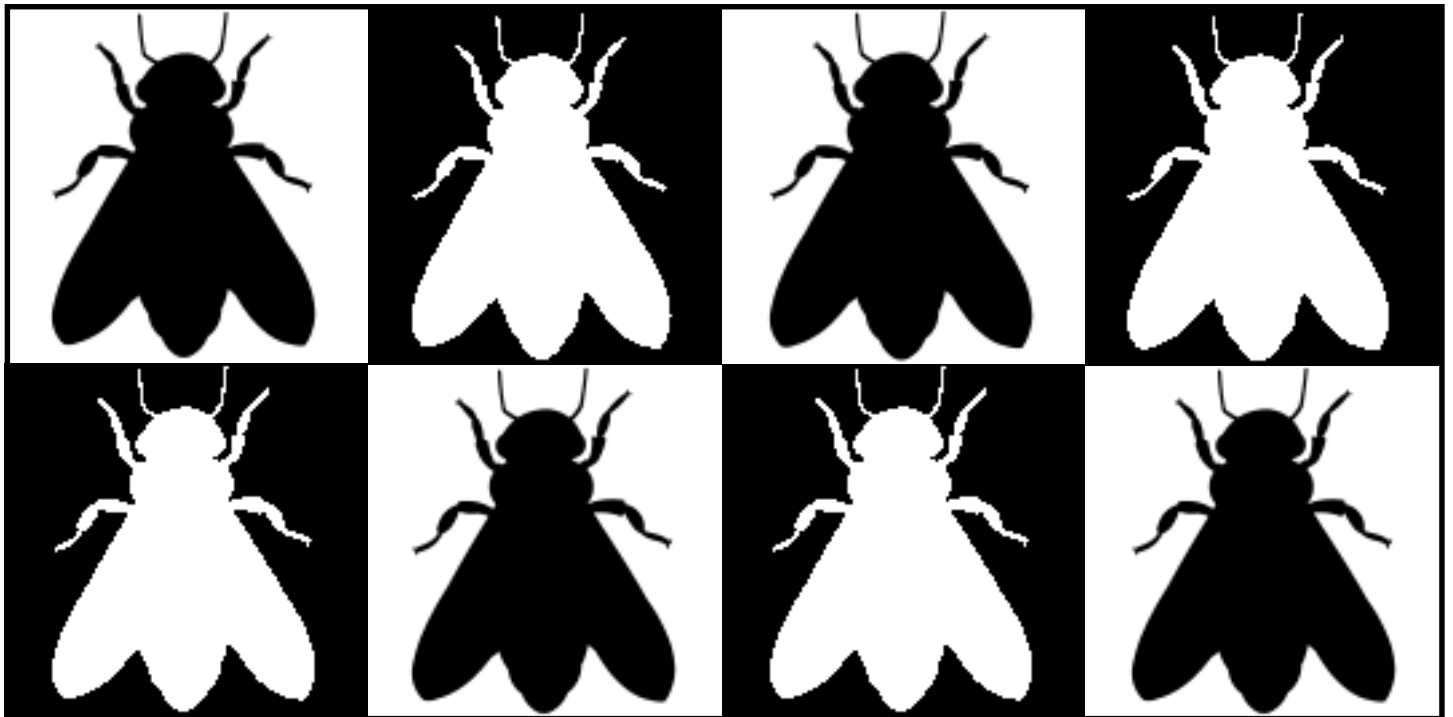




How to Reduce

BEE POISONING

From Pesticides



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How to Reduce Bee Poisoning from Pesticides

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CAUSES OF BEE POISONING

Most bee poisoning occurs when insecticides are applied to crops during the blooming period. Other hazards are

- Drift of toxic pesticides onto adjoining crops or weeds that are in bloom.
- Contamination of flowering cover crops when orchards are sprayed.
- Insecticidal dusts adhere to foraging bees and ultimately become packed with the pollen onto the hind legs. Pennncap-M and Sevin are especially dangerous because they may be stored with pollen and kill newly emerged workers the following season.
- Bees drinking or touching contaminated water on foliage or flowers.
- Bees collecting contaminated pollen or nectar.

BEE POISONING SYMPTOMS

The most common symptom of bee poisoning is the appearance of excessive numbers of dead bees in front of the hives. Another common symptom is lack of foraging bees. Aggressiveness in bees may be caused by most pesticides. Stupor, paralysis, and abnormal activities of bees are commonly caused by chlorinated hydrocarbons and organophosphorus insecticides. Regurgitation of the honey stomach contents is often caused by poisoning with organophosphorus insecticides. Bees may perform abnormal communication dances on the horizontal landing board at the hive entrance while under the influence of insecticide poisoning. Disorganized behavior patterns may lead to lack of recognition of affected field bees by guard bees.

Many bees poisoned with Sevin or dieldrin slow down and appear as though they had been chilled;

such bees may take two to three days to die. Beekeepers familiar with Sevin poisoning quickly learn to recognize the "crawlers" that move about in front of the hive but are unable to fly. Dead brood in or in front of the hive is typical of Sevin, microencapsulated methyl parathion (Pennncap-M), or arsenical poisoning. When not enough hive bees are left to cover the brood frames or care for the brood, desiccation or starvation kills the larvae. In severe cases, few bees in the hives survive, or the entire colony may be dead.

One forager returning to the hive with a load of contaminated pollen or nectar can cause extreme agitation and death of a number of bees. Several such foragers can seriously disrupt and damage the colony. Often, the queen is superseded because of the agitation of the workers, possibly aggravated by a reduction in the secretion of queen substance.

Queens may be affected, especially by slow-acting materials such as arsenicals, Sevin, and microencapsulated methyl parathion (Pennncap-M), which may be taken into the hive with pollen. Queens may behave abnormally: for instance, lay eggs in a poor pattern. Severely weakened or queenless colonies will not live through the following winter. Queenlessness the following fall have been associated with the use of a wide variety of insecticides including arsenicals, Pennncap-M, Sevin, and parathion. Typically, severe Sevin or Pennncap-M poisoning makes at least half of the colonies queenless within 30 days.

BEEKEEPER-GROWER COOPERATION

A major consideration for the reduction of bee poisoning is beekeeper-grower cooperation. Many cases could be cited where a grower, simply through ignorance of the hazard to bees, has

caused tremendous damage to a large number of colonies. The timing or materials of the pest control program could have been modified so that little or no poisoning occurred. In many cases this can be done without unduly increasing the control cost or inconveniencing the grower.

Beekeepers should get acquainted with the farmer on whose land they place hives. They should know about pest-control practices and other special problems that might occur.

When the grower rents colonies for crop pollination, definite verbal or written agreements can be made. One type of written contract emphasizes crop production and has the desirable effect of encouraging closer cooperation between the grower and the beekeeper. Such contracts should include details of the responsibility of the beekeeper in providing strong and effective colonies and of the farmer in safeguarding the bees from poisoning. In modern agriculture, the beekeeper often depends on the grower for bee forage and the grower depends on the beekeeper for pollination. Cooperation and understanding of each other's problems are essential.

REGULATIONS

Many states have regulations that attempt to reduce the hazard of insecticide applications to bees. These are based on the safest timing and bloom conditions for given chemicals on given crops. **Note: Some of the listed pesticides have been discontinued and are no longer available or legal to use.**

REDUCTION OF BEE POISONING

Following are some of the ways to help reduce bee poisoning:

What the Pesticide Applicator Can Do

- Do not apply insecticides that are toxic to bees on crops in bloom, including cover crops in orchards and adjacent crops or interplants. With aerial application, do not turn the aircraft or transport materials back and forth across blossoming fields. Ground application is generally less hazardous than aerial application because less drift of the pesticides occurs, and smaller acreages are treated at one time.
- Apply certain chemicals only in late evening, night, or early morning while bees are not actively foraging (generally between 6 p.m. and 7 a.m. in the north and 8:30 p.m. to 4 a.m. in the south). Evening applications are generally less hazardous to bees than early morning applications. When high temperatures cause bees to start foraging earlier or continue later than usual (5:30 a.m. to 8:00 p.m.) shift time accordingly.
- Do not apply insecticides when temperatures are expected to be unusually low following treatment or on nights when dews occur. Residues will remain toxic to bees for a much longer time under such conditions.
- Do not dump unused dusts or sprays where they might become a bee poisoning hazard. Sometimes bees collect any type of fine dust material when pollen is not readily available. Under such conditions, they may actually carry pesticide dusts back to the colony.
- Use insecticides that are relatively nonhazardous to bees whenever such choices are consistent with other pest control considerations.
- Choose the less hazardous insecticide formulations. Our tests have consistently indicated dusts are more hazardous than sprays of the same insecticide. Emulsifiable (liquid) formulations usually have a shorter residual toxicity to bees than do wettable powders. Granular formulations are low in hazard to bees.
- Contact and ask the beekeeper to remove colonies from the area (or keep the bees confined during the application period) before applying hazardous pesticides when such measures are feasible and of value.
- When roadside and other weed control operations involve 2,4-D and similar compounds on blooming plants, select the formulations or derivatives known to be least harmful to bees. Our tests have shown that at maximum dosage, alkanolamine salts and isopropyl esters are more

toxic than other forms. Oily formulations seem to be more hazardous to bees. Spraying in late afternoon or evening will also lessen the hazard, since bees will not visit the blooms after they become curled. The only highly toxic herbicides are arsenicals and DNOSBP.

- Observe State Department of Agriculture regulations aimed at reducing bee poisoning.

What the Grower Can Do

- Mow or beat down orchard cover crops before applying sprays hazardous to bees. Treatment with 2,4-D is the best way to remove dandelion blooms. This is especially important in relation to the first cover spray on apples, applied during a critical foraging period when bees will fly several miles to obtain pollen and nectar from even a few blooms of dandelion, or mustard.
- Blossom-thinning sprays have not been hazardous to bees in Washington orchards. However, Sevin used as a fruit thinner can be hazardous if cover crop blooms become contaminated.
- Learn the pollination requirements of the crops you raise. Such information is not generally known for some insect-pollinated crops, such as lima beans. Application of insecticides hazardous to bees on these crops, or driving beekeepers out of your area by the use of insecticides on other blossoming crops will likely cause poor yields.
- When insect pests have been damaging a crop every season, use a preventive program of early season application before pest population increases, foliage growth, and weather conditions reduce the effectiveness of insecticides. Such a program is usually less dangerous to pollinating bees and other beneficial insects as well.
- Learn about the beekeeper's problems with chemical poisoning and enter into mutually advantageous agreements to best produce bee-pollinated crops.

What the Beekeeper Can Do

- Do not leave unmarked colonies of bees next to orchards or fields. Post your name, address, and

phone number in printing large enough to be read at some distance in all apiaries so you can be contacted readily to move the colonies when hazardous sprays are to be applied. Several regulations concerning such marking of apiaries are in effect in the Pacific Northwest.

- Do not move hives back into fields treated with hazardous insecticides until at least 48 to 72 hours after the application. Our tests have shown that 50% to 90% percent of the killing of bees by insecticides occurs during the first 24 hours after application.
- Choose apiary sites that are relatively isolated from intensive insecticide applications and not normally subjected to drift of chemicals. Establish holding yards of honey bee colonies at least 4 miles from orchards being treated with toxic materials.
- Learn about pest control problems and programs so you can develop mutually beneficial agreements with growers concerning pollination service and prudent use of pesticides.
- Be careful how you control insect pests around beekeeping storage facilities or apiaries. Vapona "No Pest Strips" will also contaminate beeswax and kill bees when the combs are put in colonies later. Use relatively low-hazard materials, such as Sevin bait granules for ant control and pyrethrum aerosols for fly control.
- Cover honey bee colonies with wet burlap for two or three days to protect them from the initial hazards of an insecticide. Such covers should be put over the hives during the night before the crop is treated and should be kept wet during use. This method works; however, most beekeepers find it impractical.

POISONING OF WILD BEES

Much of the research data on the effects of insecticides on species of wild bees has been done at WSU. Our work on the effects of chemicals on the alkali bee, *Nomia melanderi*, and the alfalfa leafcutting bee, *Megachile rotundata*, has been the most extensive to date.

The alfalfa leafcutting bee can be safeguarded by storing the nest units in a cool room or root cellar for a few days while the field is being treated. Nests with females in the ends of the tunnels can be moved at night. This bee is nearly inactive at 70°F and completely inactive at 60°F. Leafcutter nest shelters can be built to be covered or closed during insecticide applications to reduce the drift of dusts or sprays into the nest structures. When placing leafcutters on fields in a rotation plan, do not move nest shelters in until at least 1 week after Lorsban, Cygon, Supracide, Furadan, or malathion ULV treatments.

Do not allow insecticide dusts or sprays to drift onto alkali bee nest sites or blooming crops on which these bees are foraging.

Do not spray chemicals on or burn adjacent wild land or fence rows around red clover, cranberry, or other berry crops. Such areas provide nest sites for bumble bees that aid materially in pollinating these crops.

A classification of the relative hazard of insecticides to wild bees is presented in Table 4.

SPECIAL PRECAUTIONS

1. There is a special tendency for Penncap-M to adhere to bees foraging on contaminated flowers. Ultimately, this material is combed from the bee hairs and deposited with the pollen on the

pollen baskets. It can be a long-term hazard when stored in pollen in beehives from one season to the next.

2. Do not use Thimet G, Di-Syston G, Phosdrin, TEPP, and methyl parathion where there is a possible fumigation hazard to alfalfa leafcutting bee shelters, alkali bee nest sites, or honey bee apiaries.
3. Undiluted or ultralow volume technical malathion spray treatments can retain a high residual toxic hazard to honey bees for at least 5 days, and to alfalfa leafcutting bees for at least 7 days.
4. Bees are temporarily inactivated by direct contact with oil sprays and some loss may occur.
5. Acidified spray mixtures with Dylox are more hazardous to bees than nonacidified sprays of this material. Do not use more than recommended rates of acidifiers.
6. Alfalfa leafcutting bees are much more sensitive to all chemicals after they have been in the field for 3 weeks or more. Time late applications to occur 6 to 7 weeks after the start of activity in the field to coincide with the natural lull between peaks of bee emergence.
7. Specific miticides such as Kelthane and Comite should not be applied in mixtures with insecticides because this increases the hazard to bees.
8. Do not treat during warm evenings when honey bees are clustered on the outside of the hives.

Note: Some of the listed pesticides have been discontinued and are no longer available or legal to use.

**TABLE 1. TOXICITY OF INSECTICIDES AND ACARICIDES TO HONEY BEES
(length of residual toxic effect in hours or days)**

Do NOT apply on blooming crops or weeds.

actellic (pirimiphos-methyl) > 1 day	heptachlor > 1 day
Advantage (carbosulfan) > 3 days	Imidan (phosmet) 1–4 days
aldrin > 1 day	Karate (cyhalothrin) > 1 day
Amaze (isofenphos) > 1 day	Knox Out (encapsulated diazinon) > 2 days
Ambush (permethrin) 1–2 days§	Lance (cloethocarb) > 1 day
Ammo (more than 0.025 lb/acre) (cypermethrin) > 3 days	Lannate D (methomyl) > 1 day
Asana (esfenvalerate) (more than 0.1 lb/acre) 1 day§	lead arsenate > 1 day
Avermectin (more than 0.025 lb/acre) 1–3 days	Legion (chlorpyrifos) 3–4 days
Azodrin (monocrotophos) > 1 day*	lindane > 2 days
Baygon (propoxur) 1 day	Lock-on (chlorpyrifos) 4–6 days
Baytex (fenthion) 2–3 days	Lorsban (chlorpyrifos) 4–6 days
Baythion (phoxim) > 1 day	malathion D or WP 2 days
Baythroid (cyfluthrin) > 1 day	malathion ULV (8 fl oz/acre or more) 5.5 days
Bidrin (dicrotophos) 1.5 days	Matacil (aminocarb) (1 lb/acre or more) > 3 days
Bolstar (sulprofos) > 1 day	Mesurool (methiocarb) > 3 days
bomyl 2 days	methyl parathion 2 days
Brigade (bifenthrin) > 1 day	Monitor (methamidophos) 1 day*
Capture (bifenthrin) (more than 0.06 lb/acre) > 1 day	Mustang (zetacypermethrin) > 1 day
Cidial (phenthoate) > 1 day	Nexagon (bromophos-ethyl) > 1 day
Comply (fenoxycarb) 1 day	Nudrin D (methomyl) > 1 day
Cygon (dimethoate) 3 days	Orthene (acephate) > 3 days
Cymbush (cypermethrin) > 3 days	Pact (thiantrile) > 1 day
Danitol (fenpropathrin) 1 day	parathion 1 day
Dasanit (fensulfothion) 1 day	Pennacp-M (methyl parathion) 5–8 days*
De-Fend (dimethoate) 3 days	phosphamidon 1–2 days
diazinon 2 days	Pounce (permethrin) 1–2 days§
Dibrom D or WP (naled) > 1 day	Pydrin (more than 0.1 lb/acre) 1 day§
dieldrin 2 days	Rebelate (dimethoate) 3 days
DNBP (dinoseb) 1 day	Sevin WP (carbaryl) 3–7 days
Dursban (chlorpyrifos) 4–6 days	Sevin-4-oil (carbaryl) (more than 0.5 lb/acre) > 3 days
Ekamet (etrimphos) > 2 days	Sevin XLR (carbaryl) (more than 1.5 lb/acre) > 1 day
Elgetol (dinitrocresol) (1.5 qt/100 gal or more) > 1 day	Standak (aldicarb sulfone) 1 day
EPN 1 day	Sumithion (fenitrothion) 1 day
Ficam (bendiocarb) > 1 day	Supracide (methidathion) 1–3 days
Folimat (omethoate) > 1 day	Talstar (bifenthrin) > 1 day
Furadan F (carbofuran) 7–14 days	Temik G (aldicarb) (applied at least 4 weeks before bloom)
Fury (zetacypermethrin) > 1 day	Vapona (dichlorvos) > 1 day
Guthion (azinphosmethyl) 2.5 days	Zectran (mexacarbate) 1–2 days

Apply ONLY during late evening. (See caution at end of table.)

Admire (imidacloprid) < 8 hours	Pydrin (fenvalerate) (0.1 lb/acre or less) 6 hours
Andalin (flucycloxonon) < 8 hours	Regent (fipronil) < 8 hours
Avermectin (0.025 lb/acre or less) 8 hours	Savit (carbaryl) (1.5 lb/acre or less) 8 hours†
Confirm (tebufenozide) < 8 hours	Sevin XLR (carbaryl) (1.5 lb/acre or less (not > 1:19 dilution) 8 hours†
Dibrom EC (naled) 16 hours	Thimet EC (phorate) 5 hours
Dursban ULV (chlorpyrifos) (0.05 lb/acre or less) < 2 hours	Thiodan (endosulfan) (more than 0.5 lb/acre) 8 hours
malathion EC 2–6 hours	Tiovel (endosulfan) (more than 0.5 lb/acre) 8 hours
Phosdrin (mevinphos) < 5 hours	Triumph (isazophos) 8 hours
Provado (imidacloprid) < 8 hours	Vydate (oxamyl) (1 lb/acre or more) 8 hours

§Safened by repellency under arid conditions.

*Can cause serious problem if allowed to drift into vegetable or legume seed crops.

†These materials are more hazardous to bees in a moist climate such as western Washington and Oregon and under slow-drying conditions.

(Continued on next page)

Apply ONLY during late evening, night, or early morning. (See caution at end of table.)

Abate (temephos) 3 hours	methoxychlor 2 hours
Adios (carbaryl) < 2 hours	Mobilawn (dichlorfenthion) 2 hours
Alert (chlorfenapyr) < 4 hours	Morocide (binapacryl) < 2 hours
Ammo (cypermethrin) (0.025 lb / acre or less) < 2 hours	Nemacide (dichlorfenthion) 2 hours
Andalin (flucycloxon) < 8 hours	Neemix (azadirachtin) < 2 hours
Arbor (diofenolan) < 2 hours	Nudrin LS (methomyl) 2 hours†
Aspon (propyl thiopyrophosphate) < 2 hours	Onic (alanycarb) < 2 hours
Azatin (azadirachtin) < 2 hours	Perthane (ethylan) 2 hours
Baygon ULV (propoxur) (0.07 lb / acre or less) < 2 hours	Pirimor (pirimicarb) < 2 hours
Baytex ULV (fenthion) (0.1 lb / acre or less) 2 hours	Proclaim (emamectin benzoate) < 2 hours
Carzol (formetanate) 2 hours	Proxol (trichlorfon) 3–6 hours
chlordane < 2 hours	Pryamite (pyridaben) < 2 hours
Croneton (ethiofencarb) < 4 hours	Pyrellin < 2 hours
Curacron (profenofos) < 6 hours	Pyrenone < 2 hours
DDT < 4 hours	Rhothane (TDE) 2 hours
Decis (deltamethrin) < 4 hours	Rotenone < 2 hours
Delnav (dioxathion) < 2 hours	Ryania < 2 hours
Diatect (diatomaceous earth) < 2 hours	Scout (tralomethrin) 2 hours
dieldrin G < 2 hours	Sevin-4-oil (carbaryl) (0.5 lb / acre or less) 2 hours
Di-Syston EC (disulfoton) < 7 hours	Spur (fluvalinate) < 2 hours
Dyfonate (fonofos) < 3 hours	Sterling (pymetrozine) < 2 hours
Dylox (trichlorfon) 3–6 hours	Success (spinosad) < 2 hours
Elgetol (dinitrocresol) (1.5 pt / 100 gal or less) 2 hours	Systox (demeton) < 2 hours
endrin 2 hours	TEPP < 5 hours
ethion 3 hours	Thanite (isobornyl thiocyanate) < 3 hours
Fulfill (pymethrozine) < 2 hours	Thimet G (phorate) < 2 hours
Gardona (tetrachlorvinphos) < 2 hours	Thiodan (endosulfan) (0.5 lb / acre or less) 2–3 hours
heptachlor G < 2 hours	Thirethrin (endosulfan) 3 hours
horticultural mineral oils < 3 hours	Tiovel (endosulfan) (0.5 lb / acre or less) 2–3 hours
Lannate LS (methomyl) 2 hours†	Torak (dialifor) < 2 hours
Larvin (thiodicarb) < 2 hours	toxaphene 2–4 hours
Malathion ULV (3 fl oz / acre or less) 3 hours	Trigard (cyromazine) < 2 hours
Matacil ULV (aminocarb) (2.4 oz / acre or less) < 2 hours	Trithion (carbophenothion) 2–5 hours
Mavrik (fluvalinate) < 2 hours	Vapona ULV (dichlorvos) (0.1 lb / acre or less) < 2 hours
menazon < 2 hours	Vydate (oxamyl) (0.5 lb / acre or less) 3 hours
Metasystox-R (oxydemeton-methyl) < 2 hours	Zolone (phosalone) 2 hours

Can be applied at any time with reasonable safety to bees.

Acarol (bromopropylate)	Furadan G (carbofuran)
allethrin	Garlic Barrier (garlic)
Apollo (clofentezene)	Heliothis polyhedrosis virus (Elcar)
BAAM (amitraz)	Hot Pepper Wax
<i>Bacillus thuringiensis</i> (Bactospeine, Bactur, Bakthane, Bug Time, Cekubacilina, Certan, Di Beta, Dipel, Foil, Javlin or Sok-Bt)	Karathane (dinocap)
Baygon G (propoxur)	Kelthane (dicofol)
chlorobenzilate	Knack (pyriproxifen)
chloropropylate	Kroyocide (cryolite)
Comite (propargite)	Lethane 384 (butoxy thiocyanodiethyl ether)
cryolite	lime-sulfur
Dasanit G (fensulfothion)	malathion G
Demize (D-Limonene)	Margosan-O (neem oil)
diazinon G	Metaldehyde bait
Dikar	Micasin (chlorfensulphide)
Dimilin (diflubenzuron)	Milbex (chlorfensulphide)
Di-Syston G (disulfoton)	Mirex G
	Mitac (amitraz)
	Mocap G

†These materials are more hazardous to bees in a moist climate such as western Washington and Oregon and under slow-drying conditions.

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Morestan (oxythioquinox)	ryania
M-Pede (soap)	Savey (hexythiazox)
Naturalis-L (<i>Beauveria bassiana</i>)	schradan
nicotine sulfate	Sevin bait G (carbaryl)
Omite (propargite)	Sevin G (carbaryl)
Ovex (chlorfenson)	sodium fluosilicate baits
Pentac (dienochlor)	sulfur
Plictran (cyhexatin)	Tedion (tetradifon)
pyrethrum	Vendex (fenbutatin-oxide)
rotenone	

CAUTION: Timing of insecticide applications in respect to bee poisoning hazard can be drastically modified by abnormal weather conditions. If temperatures are unusually low following treatment, residues on the crop may remain toxic to bees up to 20 times as long as during reasonably warm weather. Conversely, if abnormally high temperatures occur during late evening or early morning, bees may actively forage on the treated crop during these times.

TABLE 2. TOXICITY OF HERBICIDES, BLOSSOM AND FRUIT THINNERS, DESICCANTS, AND PLANT GROWTH REGULATORS TO HONEY BEES

Do NOT apply on blooming crops or weeds.

arsenic trioxide and other inorganic arsenicals	Elgetol (dinitrocresol) (1.5 qt/100 gal or more)
DNBP (dinoseb)	Sevin WP (carbaryl)

Apply ONLY during late evening, night, or early morning on blooming crops or weeds.

Amino Triazole (amitrole)	Fusilade (fluazifop-butyl)
2,4-D (alkanolamine salts)	Hyvar X (bromacil)
2,4-D (butoxyethanol ester)*	Savit (carbaryl)
2,4-D (isopropyl ester)	Sevin XLR (carbaryl)
Elgetol (dinitrocresol) 1.5 qt/100 gal or less)	Simazine
endothall	Weedone LV4 (butoxyethanol ester of 2,4-D)*

Can be applied at any time with reasonable safety to bees.

Alar (daminozide)	Eptam (EPTC)
Amiben (chloramben)	Ethrel (ethephon)
Ammate (AMS)	Goal (oxyfluorfen)
Ammonium thiosulfate	IPC (propham)
atrazine	Karmex (diuron)
Avenge (difenzoquat)	Kerb (pronamide)
Banvel (dicamba)	Lasso (alachlor)
Butoxone (2,4-DB)	MCPA
Carbyne (barban)	Monobor-Chlorate
Chloro IPC (chlorpropham)	NAA (naphthaleneacetic acid)
2,4-D (butyl ether ester)*	paraquat
2,4-D (isooctyl ester)	Roundup (glyphosate)
2,4-D (sodium salts)	Sencor (metribuzin)
dalapon	Silvex (2,4,5-TP)
2,4-DB	Sinbar (terbacil)
Desiccant (arsenic acid)	2,4,5-T
diquat	Tordon (picloram)
Endothall	Treflan (trifluralin)

*There is field evidence that butyl derivatives of 2,4-D have a long-term chronic toxicity to bees, especially in cool climates and when nectar forage plants are treated.

TABLE 3. TOXICITY OF FUNGICIDES TO HONEY BEES

Apply ONLY during late evening, night, or early morning.

Morocide (binapacryl)

Can be applied at any time with reasonable safety to bees.

Aliette (Fosetyl-AL)	lime-sulfur
Arasan (thiram)	maneb
Baycor (bitertanol)	manzeb
Bayleton (triadimefon)	Morestan (oxythioquinox)
Benlate (benomyl)	Nustar
Bordeaux mixture	Phygon (dichlone)
copper sulfate	prochoraz
Cyprex (dodine)	Rally (myclobutanil)
Dessin (dinobuton)	Ronilan
Dikar (Dithane and Karathane)	Rovral
Dithane M-22 (maneb)	Rubigan (fenarimol)
Dithane M-45 (manzeb)	sulfur
Dithane Z-78 (zineb)	Syllit (dodine)
ferbam	Tag (PMA)
fixed copper	Thylate (thiram)
Funginex (triforine)	Vitavax (carboxin)
glyodin	Zerlate (ziram)
Karathane (dinocap)	

TABLE 4. TOXICITY OF INSECTICIDES AND ACARICIDES TO WILD BEES

ALFALFA LEAFCUTTING BEE (See 6 under Special Precautions, p.5.)
(length of residual toxic effect in hours or days)

Do NOT apply on blooming crops or weeds.

Actellic (pirimiphos-methyl) > 1 day	DDT 1-2 days
Advantage (carbosulfan) 2 days	endrin 2.5 days
aldrin > 1 day	ethion 2.5 days
Amaze (isofenphos) > 1 day	Furadan F (carbofuran) 7-14 days
Ambush (permethrin) > 2 days	Fury (zetacypermethrin) > 1 day
Ammo (cypermethrin) (more than 0.025 lb/acre) > 3 days	Gardona D (tetrachlorvinphos) 1 day
Avermectin (more than 0.025 lb/acre) > 8 hours	Guthion (azinphosmethyl) > 3 days
Azodrin (monocrotophos) > 1 day	Imidan (phosmet) > 1 day
Baygon (propoxur) 1 day	Karate (cyhalothrin) > 1 day
Bidrin (dicrotophos) 2.5 days	Lannate (methomyl) (0.5 lb/acre or more) 6-15 hours
Brigade (bifenthrin) > 1 day	Larvin (thiodicarb) > 1 day
Capture (bifenthrin) > 1 day	Legion (chlorpyrifos) > 3-4 days
Carzol (formetanate) (0.5 lb/acre or more) 14 hours	Lorsban (chlorpyrifos) 6-7 days
Cidial (phenthoate) > 1 day	malathion > 2 days
Cygon (dimethoate) > 3 days	Malathion ULV 7 days
Cymbush (cypermethrin) > 3 days	methoxychlor D > 1 day
Danitol (fenpropathrin) > 1 day	methyl parathion 1 day
De-Fend (dimethoate) > 3 days	Monitor (methamidophos) 1 day
diazinon 2 days	Mustang (zetacypermethrin) > 1 day
Di-Syston (disulfoton) 13 hours	Nudrin (methomyl) (0.5 lb/acre or more) 6-15 hours

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Orthene (acephate) > 3 days
 parathion 1–3 days
 PennCap-M (methyl parathion) 8 days
 phosphamidon 2 days
 Pounce (permethrin) > 2 days
 Primidic (pirimiphos-ethyl) > 2 days
 Pydrin (fenvalerate) 9 hours
 Pyramite (pyridaben) > 8 hours
 Rebelate (dimethoate) > 3 days
 Regent (fipronil) > 1 day
 Sevin (carbaryl) 3–7 days
 Sterling (pymetrozine) > 1 day

Success (spinosad) > 1 day
 Sumithion (fenitrothion) > 1 day
 Supracide (methidathion) 1–3 days
 Temik G (aldicarb) (applied at least 4 weeks before bloom)
 Thiodan (endosulfan) (0.5 lb/acre) 1–3 days
 Tiovel (endosulfan) (0.5 lb/acre) 1–3 days
 toxaphene 3–7 days
 Trigard (cyromazine) > 1 day
 Trithion (carbophenothion) 2 days
 Vydate (oxamyl) (1 lb/acre) > 1 day

Apply ONLY during late evening. (See caution at end of table.)

Actellic (pirimiphos-methyl) 9 hours
 Admire (imidacloprid) 8 hours
 Alert (chlorfenapyr) 8 hours
 Andalin (flucyclozoxon) 8 hours
 Arbor (diofenolan) 8 hours
 Asana (esfenvalerate) (0.0375 lb/acre or less) 8 hours
 Capture (bifenthrin) (0.032 lb/acre or less) 4–6 hours
 Carzol (formetanate) (0.25 lb/acre or less) 4–12 hours
 Decis (deltamethrin) < 8 hours
 Delnav (dioxathion) 9 hours
 Dibrom EC (naled) 12 hours
 Fulfill (pymethrozin) 2 hours

Lannate (methomyl) (0.25 lb/acre or less) < 4 hours
 Larvin (thiodicarb) 8 hours
 Metasystox-R (oxydemeton-methyl) < 4 hours
 methoxychlor WP 12 hours
 Morestan (oxythioquinox) 6 hours
 Nudrin (methomyl) (0.25 lb/acre or less) < 4 hours
 Phosdrin (mevinphos) < 5 hours
 Provado (imidacloprid) 8 hours
 Scout (tralomethrin) < 8 hours
 TEPP < 5 hours
 Vydate (oxamyl) (0.5 lb/acre or less) 3–9 hours

Apply ONLY during late evening, night, or early morning. (See caution at end of table.)

Adios (carbaryl) 2 hours
 Ammo (cypermethrin) (0.025 lb/acre or less) 2 hours
 Avermectin (0.025 lb/acre or less) < 2 hours
 Azatin (azadirachtin) < 2 hours
 Demize (D-Limonene) < 2 hours
 Diatect (diatomaceous earth) < 2 hours
 Dylox (trichlorfon) 2–5 hours
 Fusilade
 Knack (pyriproxifen) < 2 hours
 Mavrik (fluvalinate) 2 hours
 methoxychlor EC 2–4 hours
 Neemix (azadirachtin) < 2 hours

Onic (alanycarb) < 2 hours
 Pirimor (pirimicarb) < 2 hours
 Proclaim (emamectin benzoate) < 2 hours
 Proxol (trichlorfon) 2–5 hours
 Pyrenone < 2 hours
 Savey (hexythiazox) < 2 hours
 Sevin XLR (carbaryl) (1.5 lb/acre or less) 3 hours
 Spur (fluvalinate) 2 hours
 Systox (demeton) < 3 hours
 Tedion (tetradifon) < 3 hours
 Thimet G (phorate) < 2 hours
 Zolone (phosalone) < 2 hours

Can be applied at any time with reasonable safety to bees.

Bacillus thuringiensis
 Baygon G (propoxur)
 Comite (propargite)
 Di-Syston G (disulfoton)

Furadan G (carbofuran)
 Kelthane (dicofol)
 menazon
 Omite (propargite)

ALKALI BEE
(length of residual toxic effect in hours or days)

Do NOT apply on blooming crops or weeds.

Ambush (permethrin) 1–2 days
 Azodrin (monocrotophos) > 1 day
 Baygon (propoxur) 1 day
 Bidrin (dicrotophos) 2–4 days

Cidial (phenthoate) > 1 day
 Cygon (dimethoate) 2–3 days
 Danitol (fenpropathrin) > 1 day
 De-Fend (dimethoate) 2–3 days

diazinon 1.5 days
 dieldrin > 1 day
 EPN 1 day
 Furadan F (carbofuran) 7–14 days
 Fury (zetacypermethrin) > 1 day
 Gardona D (tetrachlorvinphos) 1 day
 Guthion (azinphos-methyl) 3 days
 Imidan (phosmet) > 1 day
 Lannate (methomyl) (0.5 lb/acre or more) > 1 day
 Larvin (thiodicarb) > 1 day
 Legion (chlorpyrifos) 3–4 days
 Lorsban (chlorpyrifos) 3–6 days
 malathion ULV > 5 days
 methyl parathion 1 day
 Monitor (methamidophos) 1 day
 Mustang (zetacypermethrin) > 1 day

Nudrin (methomyl) (0.5 lb/acre or more) > 1 day
 Orthene (acephate) > 3 days
 parathion 1 day
 Penncap-M (methyl parathion) > 2 days
 phosphamidon 1–2 days
 Pounce (permethrin) 1–2 days
 Pydrin (fenvalerate) (over 0.1 lb/acre) 1 day
 Rebelate (dimethoate) 2–3 days
 Sevin (carbaryl) 3–7 days
 Supracide (methidathion) 1–3 days
 Temik G (aldicarb) (applied at least 4 weeks before bloom)
 Thiodan (endosulfan) (1 lb/acre or more) 1 day
 Trigard (cyromazine) 1 day
 Vydate (oxamyl) (1 lb/acre) > 1 day

Apply ONLY during late evening. (See caution at end of table.)

Admire (imidacloprid) 8 hours
 Alert (chlorfenapyr) 4 hours
 Andalin (flucyclozoxon) 4 hours
 Arbor (diofenolan) 4 hours
 Asana (esfenvalerate) (0.0375 lb/acre or less) 8 hours
 Capture (bifenthrin) (0.032 lb/acre or less) 4–6 hours
 Carzol (formetanate) (1 lb/acre or more) 9 hours
 Decis (deltamethrin) < 8 hours
 Dibrom (naled) 12 hours
 Dylox (trichlorfon) 6–14 hours
 endrin 8 hours
 Gardona EC (tetrachlorvinphos) 10 hours
 Imidan (phosmet) (0.5 lb/acre or less) 12 hours
 Lannate (methomyl) (0.5 lb/acre) 5.8 hours
 Larvin (thiodicarb) 5 hours
 malathion EC 1.5 days
 Mavrik (fluvalinate) 8 hours

methoxychlor WP 8 hours
 Nudrin (methomyl) (0.5 lb/acre) 5–8 hours
 Phosdrin (mevinphos) < 5 hours
 Provado (imidacloprid) 8 hours
 Proxol (trichlorfon) 6–14 hours
 Pyramite (pyridaben) 2 hours
 Pydrin (fenvalerate) (0.1 lb/acre or less) 8 hours
 Regent (fipronil) 6 hours
 Scout (tralomethrin) < 8 hours
 Spur (fluvalinate) 8 hours
 Sterling (pymetrozine) 8 hours
 Success (spinosad)
 Thiodan (endosulfan) (0.5 lb/acre or less) 5 hours
 toxaphene 10 hours
 Trithion (carbophenothion) 9 hours
 Vydate (oxamyl) (0.5 lb/acre or less) 3–9 hours

Apply ONLY during late evening, night, or early morning. (See caution at end of table.)

Adios (carbaryl) 2 hours
 Avermectin < 2 hours
 Azatin (azadirachtin) < 2 hours
 Carzol (formetanate) (0.5 lb/acre or less) 3 hours
 DDT < 4 hours
 Demize (D-Limonene) < 2 hours
 Diatect (diatomaceous earth) < 2 hours
 Di-Syston EC (disulfoton) < 2 hours
 Fulfill (pymethroline) < 2 hours
 Knack (pyriproxifen) < 2 hours
 Lannate (methomyl) (0.25 lb/acre or less) 2 hours
 Metasystox-R (oxydemeton-methyl) < 2 hours
 methoxychlor EC < 2 hours
 Morestan (oxythioquinox) < 4 hours

Neemix (azadirachtin) < 2 hours
 Nudrin (methomyl) (0.25 lb/acre or less) 2 hours
 Onic (alanycarb) < 2 hours
 Pirimor (pirimicarb) < 2 hours
 Proclaim (emamectin benzoate) < 2 hours
 Pyrenone < 2 hours
 Savey (hexythiazox) < 2 hours
 schradan < 2 hours
 Systox (demeton) < 2 hours
 TEPP < 5 hours
 Thimet G (phorate) < 2 hours
 Thirethrin (endosulfan) < 2 hours
 Zolone (phosalone) < 2 hours

Can be applied at any time with reasonable safety to bees.

Bacillus thuringiensis
 Baygon G (propoxur)
 Comite (propargite)
 Di-Syston G (disulfoton)

Furadan G (carbofuran)
 Kelthane (dicofol)
 Omite (propargite)
 Tedion (tetradifon)

BUMBLEBEES

Do NOT apply on blooming crops or weeds.

Bidrin (dicrotophos)	parathion
Cygon (dimethoate)	PennCap-M (methyl parathion)
De-Fend (dimethoate)	Pydrin (fenvalerate)
diazinon	Rebelate (dimethoate)
Furadan F (carbofuran)	Sevin (carbaryl)
Guthion (azinphos-methyl)	Supracide (methidathion)
Lorsban (chlorpyrifos)	Temik G (aldicarb) (applied at least 4 weeks before bloom)
malathion ULV	
Orthene (acephate)	

Apply ONLY during late evening. (See caution at end of table.)

Dibrom (naled)	TEPP
malathion EC	

Apply ONLY during late evening, night, or early morning. (See caution at end of table.)

Carzol (formetanate)	Metasystox-R (oxydemeton-methyl)
DDT	Nudrin (methomyl)
Di-Syston EC (disulfoton)	Systox (demeton)
Dylox (trichlorfon)	toxaphene
Lannate (methomyl)	

Can be applied at any time with reasonable safety to bees.

Baygon G (propoxur)	Furadan G (carbofuran)
Comite (propargite)	Kelthane (dicofol)
Di-Syston G (disulfoton)	Omite (propargite)

CAUTION: Timing of insecticide applications in respect to bee poisoning hazard can be drastically modified by abnormal weather conditions. If temperatures are unusually low following treatment, residues on the crop typically remain toxic to bees about twice as long as during reasonably warm weather. Conversely, if abnormally high temperatures occur during late evening or early morning, bees may actively forage on the treated crop during these times.

▲Warning. Use pesticides with care. Apply them only to plants, animals, or sites listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

TOXICITY OF PESTICIDES TO HONEY BEES, ALFALFA LEAFCUTTING BEES, AND ALKALI BEES

Pesticide	Honey bee	Alfalfa leaf- cutting bee	Alkali bee	Pesticide	Honey bee	Alfalfa leaf- cutting bee	Alkali bee	Pesticide	Honey bee	Alfalfa leaf- cutting bee	Alkali bee
Actellic	1	1	0	Brigade	1	1	0	Dibrom	2	2	1
Adios	3	3	3	bromacil	3	0	0	Dibeta	2	2	2
Admire	2	2	2	Broot G	4	0	0	Diatect	3	3	3
Advantage	1	1	0	Butoxone	4	4	4	dicofol	4	4	4
Alar	4	0	0	calcium arsenate	1	1	1	dieldrin	1	1	1
aldrin	1	1	1					Dikar	4	0	0
Alert	3	2	2	captan	1	0	0				
Align	3	3	3	Capture, 0.06 lb	1	1	1	Dimilin	4	0	0
allethrin	4	0	0	or more				dinoseb	2	1	1
				Capture, less than	2	2	0	DiPel	4	4	4
Amaze	1	1	1	0.06 lb				diquat	4	0	0
Ambush	1	1	1	carboxin	4	0	0	Di-Syston EC	3	1	3
Amiben	4	0	0	Carbyne	4	0	0				
amino-triazole	3	0	0					Di-Syston G	4	4	4
amitraz	4	0	0	Carzol	3	2	3	Dithane M-22	4	0	0
				Certan	4	4	4	Dithane M-45	4	0	0
amitrole	3	0	0	chlordane	3	1	1	Dithane Z-78	4	0	0
Ammate	4	0	0	Chloro IPC	4	0	0	diuron	4	0	0
Ammo	1	1	1	Cidial	1	1	1				
Ammonium thiosulfate	4	4	4					DNBP	1	1	1
Andalin	3	2	2	Ciodrin	1	0	0	DNOC	3	1	1
Apollo	4	0	0	Comite	4	4	4	Dursban ¹	1	1	1
Arasan	4	0	0	Comite + Dylox + Systox	1	1	1	Dyfonate	3	0	0
				Confirm	2	0	0	Dylox	3	3	3
Arbor	3	2	3	copper sulfate	4	0	0	Elgetol	3	1	1
Asana	1	1	1	Comply	1	1	1	endothall	3	0	0
Aspon	2	0	0	cryolite	4	0	0	endrin	3	1	2
atrazine	4	0	0	Cygon	1	1	1	EPN	1	1	1
Avenge	4	0	0	Cymbush	1	1	1	Eptam	4	0	0
avermectin	2	3	3	cypermethrin	1	1	1				
				Cyprex	4	0	0	EPTC	4	4	4
Azatin	3	3	3	Cythion	1	1	1	ethion	3	1	1
azinphos-methyl	1	1	1					Ethrel	4	0	0
Azodrin	1	1	1	2,4-D (alkanolamine)	3	0	0	ferbam	4	0	0
Baam	4	0	0	2,4-D (butoxyethanol ester)	3	0	0	Ficam	1	1	1
<i>Bacillus thuringiensis</i>	4	4	4								
Bactimos	4	4	4	2,4-D (isooctyl ester)	4	0	0	fixed copper	4	0	0
				2,4-D (isopropyl ester)	3	0	0	Florel	4	0	0
Banvel	4	0	0	2,4-D (sodium salts)	4	0	0	flucythrinate	1	0	0
Barban	4	0	0					fluvalinate	3	3	2
Baycor	4	0	0					Folimat	1	0	0
Baygon ¹	1	1	1	dalapon	4	0	0	Fufill	3	3	3
Baygon G ¹	4	4	4	Danitol	1	1	1				
				Dasanit	1	0	0	Furadan F	1	1	1
Baygon ULV ¹	3	0	0	2,4-DB	4	4	4	Furadan G	4	4	4
Bayleton	4	0	0	DDT	3	1	3	Fury	1	1	1
Baytex ¹	1	1	1	Decis	2	2	2	Fusilade	3	0	0
Baytex ULV ¹	3	0	0					glyodin	4	0	0
Baythroid	1	0	0	De-Fend	1	1	1	Guthion	1	1	1
				Demize	4	4	4				
Benlate	4	0	0	Delnav	3	2	0	<i>Heliothis polydrosis</i> virus (Elcar)	4	0	0
BHC	1	1	1	Desiccant	4	0	0				
Bidrin	1	1	1	Dessin	4	0	0	heptachlor	1	1	1
bomy	1	1	1	diazinon	1	1	1	horticultural	3	0	0
Bordeaux Mixture	4	0	0	diazinon G	4	4	4	mineral oil			

Rating Scale

0 = No data or experience is available. Do not use.

1 = Do not apply to blooming plants.

2 = Apply in evening after bees have stopped foraging.

3 = Apply in late evening after bees have stopped foraging until early morning before they begin foraging.

4 = Apply at any time with reasonable safety to bees.

(Continued on next page)

Pesticide	Honey bee	Alfalfa leaf- cutting bee	Alkali bee	Pesticide	Honey bee	Alfalfa leaf- cutting bee	Alkali bee	Pesticide	Honey bee	Alfalfa leaf- cutting bee	Alkali bee
Hyvar X	3	0	0	Morestan	4	3	3	Sevin 4-Oil	1	1	1
Imidan	1	1	2	Morocide	3	0	0	Sevin	1	1	1
IPC	4	0	0	Mustang	1	1	1	Sevin Bait	4	4	4
Javelin	4	4	4	NAA	4	0	0	Sevin XLR	2	1	1
Karate	1	1	1	Naturalis-L	4	4	4	Sevin XLR Plus	3	1	1
Karathane	4	0	0	Neemix	3	3	3	silvex	4	0	0
Karmex	4	0	0	<i>Nosema locustae</i>	4	4	4	simazine	3	0	0
Kelthane	4	4	4	(NoLo Bait)				Sinbar	4	0	0
Kelthane + Dylox + Systox	1	1	1	Nudrin	3	2	3	Spur	3	2	2
Kerb	4	0	0	Nudrin D	1	1	1	Stalker	2	2	1
Knack	4	4	4	Omite	4	4	4	Sterling	3	3	3
Knox Out	1	1	1	Omite + Dylox + Systox	1	1	1	Stipend	1	1	1
Kryocide	4	0	0	Onic	2	0	0	Success	3	2	3
Legion	2	2	1	Orthene	1	1	1	sulfur	4	4	4
Lance	1	1	1	paraquat	4	0	0	Sumithion	1	1	0
Lannate	3	2	3	parathion	1	1	1	Supracide	1	1	1
Lannate D	1	1	1	Penncap-M	1	1	1	Systox	3	3	3
Larvin	3	1	1	Pentac	4	0	0	2,4,5-T	4	0	0
Lasso	4	0	0	Perthane	3	0	0	Tag	4	0	0
lead arsenate	1	1	1	Phosdrin	1	1	1	Talstar	1	1	1
Lexone	4	0	0	phosphamidon	1	1	1	Tedion	4	3	4
lime-sulfur	4	4	4	Phoxtex	2	0	0	Teknar	4	4	4
Lindane	1	1	1	Phygon	4	0	0	Temik	1	1	1
Lock-On	1	1	1	picloram	4	0	0	TEPP	2	1	1
Lorsban	1	1	1	Pirimor	3	3	3	terbacil	4	0	0
MCPA	4	0	0	PMA	4	0	0	Thimet G	3	3	1
malathion	2	1	1	Pounce	1	1	1	Thiodan	3	1	2
Malathion ULV	1	1	1	Primicid	1	1	0	thiram	4	0	0
maneb	4	0	0	Proclaim	3	0	0	Thirethrin	3	0	0
Manzeb	4	0	0	Provado	2	2	2	Thuricide	4	4	4
Matacil	1	0	0	Proxol	3	3	2	Thylate	4	0	0
Mavrik	3	3	2	Pydrin	1	1	1	Tiovel	3	1	2
Measurol	1	1	1	Pyramite	2	1	2	Tordon	4	0	0
Metacide	1	1	1	pyrellin	3	3	3	Toxaphen	3	1	2
Metasystox-R	3	2	3	pyrenone	3	3	3	2,4,5-TP	4	0	0
methoxychlor	3	2	3	pyrethrum	4	0	0	Treflan	4	4	4
methyl parathion	1	1	1	Rabon	1	2	3	trifluralin	4	4	4
methyl parathion (microencapsulated)	1	1	1	Rebelate	1	1	1	Trigard	3	1	1
metribuzin	4	0	0	Regent	2	1	2	Trithion	3	1	2
Mitac	4	0	0	Resmethrin	1	0	0	Trophy	1	1	1
Mobilawn	2	0	0	rotenone	3	0	0	Vapona	1	1	1
Mocap G	4	0	0	ryania	3	0	0	Vendex	4	0	0
Mocap EC	1	1	1	Roundup	4	0	0	Vitavax	4	0	0
Monitor	1	1	1	Savey	4	4	4	Vydate	3	2	2
Monobor-Chlorate	4	0	0	Savit	2	1	1	Zerlate	4	0	0
				Scout	3	2	2	ziram	4	0	0
				Sencor	4	0	0	Zolone	3	3	3
				Sevimol	1	1	1				

Note: Some of the listed pesticides have been discontinued and are no longer available or legal to use. They are included as a guide to relative toxicity. ¹Baygon, Baytex, and Dursban at mosquito abatement rates can be applied only in the evenings where honey bees are present.

Rating Scale 0 = No data or experience is available. Do not use.
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