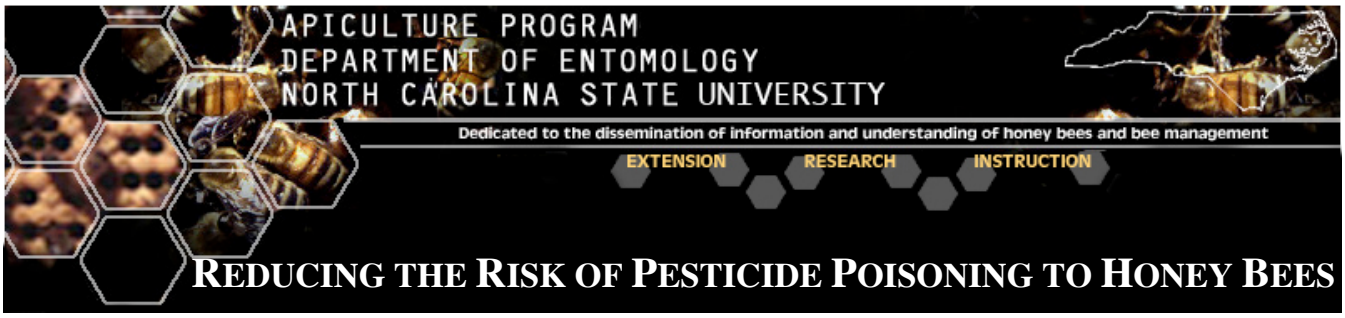

REDUCING THE RISK OF PESTICIDE POISONING TO HONEY BEES

(Previously Note #12)

Honey bees are important in agriculture, where growers of a wide variety of crops rent hives from beekeepers to pollinate their plants and help increase yields. Chemical pesticides are also important in agriculture, where growers can use any combination of insecticides, herbicides, fungicides, and other chemicals to help combat pests. These two practices can result in severe bee losses or even colony death depending on the substance, application, and other circumstances. Pesticide poisoning of honey bees can usually be kept to a minimum if beekeepers and pesticide applicators take several precautions.

PRECAUTIONS FOR THE BEEKEEPER

1. If your bees are located in an area where pesticides are commonly used, then identify yourself as a beekeeper to your neighbors who may use pesticides.
2. Identify your apiaries with your name and address or telephone number if the apiary is not associated with your residence so that you may be notified in the event that pesticides are to be used by a neighbor.
3. Explain the importance of your bees in the pollination of crops being grown on nearby fields to those growers so that they may consider the value of the bees in pollination before applying pesticides that may kill pollinating insects.
4. Be aware of the precautions that apply to the pesticide applicator (below) so that you can serve as a resource in providing solutions to reducing bee kills.
5. Some areas are used to grow crops that require heavy and frequent usage of pesticides, such areas should be avoided when selecting apiary locations.
6. Register your apiary locations with the N.C. Dept. of Agriculture if aerial applications of pesticides are to be used in the area of your apiary.
7. Cover (with wet burlap) or move your beehives if possible when bee toxic pesticides are being applied near your apiary.

PRECAUTIONS FOR THE PESTICIDE APPLICATOR

1. Always read and follow any warning statements regarding honey bees on the pesticide label.
2. If more than one product is available to control a pest, avoid using a pesticide listed in Group 1 (see below) in favor of one in Group 2 or 3.
3. Avoid applying any bee toxic pesticides on blooming plants (host crop and weeds) that attract bees and pesticide drift to nearby blooming weeds that are attracting bees.
4. Time of day of the pesticide application is very important. Pesticides that are toxic to bees should be applied in the late afternoon (after 3:00 pm) or in the evening if at all possible. Most honey bees have stopped foraging and have returned to their hives by 3:00 pm. This precaution will allow maximum time for the pesticide to break down before the bees come into contact with it the next day.
5. Select the safest formulation of the pesticide that is available for the intended use. "Drifting" of the pesticide from the target pest and/or crop to areas frequented by bees should be minimized and formulation selection is the key to this problem.
    a. "Dusts" almost always present the most drift problem of any pesticide formulation and are generally more dangerous to bees than are sprays or granular applications.
    b. Spray formulations are usually safer to bees than are dusts but there are differences among the spray formulation types. Generally water soluable formulations are safer than are emulsifiable formulations, and fine sprays are less dangerous than are course sprays. Sprays of undiluted technical pesticide (ULV) may be more dangerous than diluted sprays.
    c. Granular applications are generally the safest formulations from a drifting standpoint and the accidental killing of bees. This use should be considered if a granular formulation is suitable for controlling the target pest.
    d. Microencapsulated pesticides such as Penncap-M® present a very distinct and serious threat to honey bees. The particle size of this pesticide formulation is very similar to that of pollen and adult honey bees may carry this pesticide back to the hive where it will be combined with pollen that is being stored in the hive. This pesticide will not kill the adult bees that collected it, but the microencapsulated pesticide will kill the brood (immature) stages of the bees when it is later fed to those bees. Bees have little protection against this product. (See also item #10 in this list of precautions).
6. The mode of pesticide application is also important, particularly from a drifting standpoint. Aerial applications are generally more dangerous than applications by ground equipment because of the amount of pesticide that may drift from the target pest and or crop to nearby foraging bees or beehives. Air-blast sprayers are more dangerous than pressurized pump sprayers. *Do not apply pesticides when wind velocities exceed 8 miles per hour*; this will lessen pesticide drift and bee kills. **IF** a pesticide application is being made by air then it is the contractor's responsibility to notify any beekeepers that have "registered" apiaries (one or more hives of bees) within 2 miles of the area to be aerially sprayed. These regulations are defined in the N.C. Pesticide Laws and the person responsible for the notification is the person who contracts for the aerial application.
7. Never apply any pesticide directly over a beehive.

8. Notify beekeepers who have beehives near an area to be treated with a pesticide so that they may attempt to protect their bees against any inadvertent pesticide kills.
9. Follow proper precautions in disposing of unused pesticides and pesticide containers. Be particularly careful not to contaminate water with pesticides as the water may be collected by bees and result in bee kills.

RELATIVE TOXICITY OF PESTICIDES TO HONEY BEES

Most pesticides are at least somewhat toxic to honey bees; however, the degree of toxicity varies considerably from product to product. Insecticides are generally the most likely to cause a bee kill, while herbicides, fungicides, and defoliants present minor danger to bees if used according to label directions.

The types of pesticides available changes over time. New chemicals are constantly being added to the market, while others are being removed. Reduced-risk pesticides and natural enemies are being registered with increasing frequency. Thus the lists below are neither complete nor entirely up to date, but were accurate at the time of this publication. If a product or chemical is not listed below, you may search for its Pesticide Fact Sheet through the US Environmental Protection Agency (see link below) to see if it poses a threat to honey bee colonies.

Further information

Organization and information from Atkins, E.L. 1992. Injury to honey bees by poisoning. In: *Hive and the Honey Bee,* Dadant and Sons; Hamilton, IL pp. 1153-1208.

Searches for specific brand or chemical names can be done at
http://www.cdms.net/manuf/default.asp
http://www.greenbook.net/framegate.asp?target=Search/QuickSearch/index.asp?SearchType=2

Information from the EPA on individual chemicals can be found at
http://www.epa.gov/pesticides/factsheets/chemical_fs.htm

A listing of the most commonly used conventional pesticides can be found at
http://www.epa.gov/oppbead1/pestsales/99pestsales/table_of_contents1999.html

How to use these tables

- Pesticides are listed by their common chemical names, followed by their trade or brand name(s) in parentheses, if available.
- Pesticides introduced since 1997 are listed in ***bold italics***.
- A number before a listed chemical indicates its overall ranking of most commonly used pesticides in the US in 1999, the most recent year available for such statistics.
- Be sure to read and follow pesticide labels to optimize pest control and minimize bee kills.

Prepared by John T. Ambrose, 1997; Updated by David R. Tarpy, 2004.

GROUP 1 - HIGHLY TOXIC. Severe bee losses may be expected if the following pesticides are used when bees are present, or the product is applied near beehives, or within a day after application to foraging bees in the pesticide application area.

abamectin (agri-Mek®) acephate (Orthene®) aldicarb (Temik®) avermectin (Proclaim®) azinphos-methyl (Guthion®) bifenthrin (Brigade®, Capture®) carbaryl (Sevin® 80 S) carbofuran (Furadan®) carbosulfan (Advantage®) [16]chlorpyrifos (Dursban®, Lorsban®) ***clothianidin (Poncho 600®)*** cyfluthrin (Baythroid®) cyhalothrin (Karate®, Warrior®) cypermethrin (Ammo®)	deltamethrin (Decis®) diazinon (Kickstart®)dicrotophos (Bidrin®) dieldrin dimethoate (Cygon®) fenpropathrin (Danitol®) ***famoxadone (Famoxate™)*** imidacloprid (Provado®, Admire®) ***indoxacarb (Steward™ or Avaunt™)[contact only]*** ***LPOS (Sulfotine or RAID TVK)*** [7]malathion (Cythion®, Fyfanon®) methamidophos (Monitor®)	methidathion (Supracide®) methiocarb (Mesurol®) methomyl (Lannate®) methoprene methyl parathion (Penncap-M®) naled (Dibrom®) pemethrin (Ambush®, Pounce®) phosmet (Imidan®) propoxur (Baygon®) spinosad (XDE-105, Tracer®) thiamethoxam (Actara®) zeta cypermethrin (Mustang Max®)

GROUP 2 - MODERATELY TOXIC. These pesticides can be used in the vicinity of bees **IF** dosage, timing, and method of application are correct; but these products should never be applied directly on bees in the field or at the colony location (apiaries).

acetamiprid	oxydemeton-methyl (Metasystox-R®)
aldicarb sulfoxide	phorate (Thimet®)
Bifenazate (Floramite®, Acramite®)	profenofox (Curacron®)
Biothion	propamocarb (Carbamult®)
Chlordane	propamocarb hydrochloride (Banol®)
Coumaphos (Co-Ral®)	pyrethrum
crotoxyphos (Ciodrin®)	ronnel
demeton (Systox®)	sulprofox (Bolstar®)
disulfoton (DiSyston®)	sumithrin (Anvillollo®)
endosulfan (Thiodan®)	tartar emetic
ethoprop (Mocap®)	temephos (Abate®)
fluvalinate (Mavrik®)	terbufos (Counter®)
fonofos (Dyfonate®)	***thiacloprid (Calypso, YRC-2894)***
formetanate (Carzol®)	***thiazopyr (MANDATE, VISOR)***
oxamyl (Vydate®)	thiodicarb (Larvin®)
	zephyr

GROUP 3 - RELATIVELY NONTOXIC. These pesticides can be used around bees with a minimum of injury if dosage, timing, and method of application are correct. Never apply pesticide directly to the beehive.

Acaricides, Biopesticides, Insect Growth Regulators & Insecticides

allethrin	heliothis virus
amitraz (Mitac®)	methoxychlor (Marlate®)
azadirachtin (Margosan-O®)	methoxyfenozide (Intrepid®)
Bacillus thuringiensis (Javelin®, Dipel®, Agree®, CryMax®)	multimethylalkenols (Stirrup®)
	myriproxyfen (Esteem®, Knack®)
B. t. tenebrionis	nicotine
chlordimeform (Fundal®, Galecron®)	*Nosema locustae* (Canning®)
chlorobenzilate (Acaraben®, Folbex®)	oxythioquinox (Morestan®)
clofentizine (Apollo®)	polynactins
cryolite (Kyocide®)	propargite (Comite®, Omite®)
cymiazole (Apitol®)	***pymetrozine (Fulfill™, Endeavor™)***
cyromazine (Trigard®)	pyrethrum
dibromochloropropane (Nemagon®)	pyriproxyfen
dicofol (Kelthane®)	rotenone
diflubenzuron (Dimilin®)	tebufenozide (Confirm®)
dinobuton (Dessin®)	tetraflubenzuron (CME®)
dioxathion (Delnave®)	trichlorfon (Dylox®)
esfenvalerate (Asana®)	Z-11-hexadecanol (tomato pinworm pheromone)

Fungicides

Acibenzolar-S-methyl (Actigard®)	***cyprodinil (Vangard WP® or WG®)***	maneb
Azoxystrobin (Heritage®)	dazomet (Mylone®)	metirom (Polyram®)
anilazine (Dyrene®, Kemate®)	***dimethomorph (Acrobat MZ® or WDG®)***	nabam (Parzate®)
benomyl (Benlate®)	dichlolone	Polyphase™P-100 (Troysan®)
bordeaux mixture	diniconazole (Spotless®)	prochloraz
captafol (Difolatan®)	dinocap (Karathane®)	prochloraz/carbendazin (Sportac®)
captan (Orthocide®)	dithianon (Thynon®)	sulfur
[14]chloropicrin	dodine (Cyprex®)	thiram
[15]copper hydroxide	fenaminosulf (Lesan®)	***trifloxystrobin (Flint™, Stratego™, Compass™)***
copper oxychloride sulfate	***fenhexamid (Elevate 50 WDG)***	thiram
copper 8-quinolinate	***fluazinam (Omega 500F)***	thiramlmethoxychlor (Atasan®)
copper sulfate (monohydrated)	folpet (Phaltan®)	triforine (Funginex®)
cuprous oxide	glyodin (Glyoxide)	triphenyltin hydroxide (Du-Ter®)
cyclanilide (FINISH®)	[21]mancozeb	ziram (Zerlate®)
cymoxanil (Curzate 60 DF®)		***zoxamide (Zoxium 80W)***

Herbicides, Defoliants, Desiccants & Plant Growth Regulators

2, 3, 6-TBA (Trysben®)	diuron (Karmex®)	naptalam (Alanap®)
[6]2, 4-D (2, 4-D®)	[19]EPTC (Eptam®)	nitrofen (TOK®)
2, 4-DB (Butoxon®, Butyrac®)	[24]ethephon (Ethrel®)	norflurazon (Zorial®)
2, 4 5-T	ethalfluralin (Sonalan®)	ovasyn
[4]acetochlor	EXD (Herbisan®)	paraquat
[17]alachlor (Lasso®)	***flufenacet (Axiom DF)***	[10]pendimethalin
amitrole	fluometuron (Cotoran®)	phenmedipham (Betanal®)
ammonium sulfate	***flumioxazin (Valor WDG)***	picloram (Tordon®)
[1]atrazine (A-Atrex®)	fluridone (BRAKE®, Sonar®)	***prohexadione calcium (Apogee PGR, Baseline)***
benomyl (Benlate®)	***fluroxypyr (Starane EC)***	prometryn (Caparol®)
bentazon (Basagran®)	***fluthiacet-methyl (Action)***	pronamide (Kerb®)
bromacil (Hyvar®)	***foramsulfuron (Option)***	[18]propanil (Stam® F-34)
butifos (DEF®)	[2]glyphosate, isopropylamine salt (Roundup®)	propazine (Milogard®)
chlorbromuron (Maloran®)	hydrogen cyanamide (Dormex®)	propham (IPC7, Ban-Hoe®)
chloroxuron (Tenoran®)	imadagylin (Arsenal®)	***PT807-Hcl (Ecolyst)***
clodinafop-propergyl (Discover®)	***imazamox (Raptor®)***	Quinchlorac (FACET®)
clofencet (Genesis®)	***isoxaflutole (Balance®)***	simizine (Princep®)
cloransulam-methyl (FirstRate®)	***linuron (Lorox)***	sodium chlorate (KNOCK'UM OFF®)
cloproxydim (Select®)	MCPA (Mapica®)	terbacil (Sinbar®)
[25]cyanazine (Bladex®	***Mesotrione (Callisto)***	terbutryn
cyhalofop-butyl (Clincher®)	Metaldehyde propazine (Milogard®)	thiadiazuron (DROPP®)
dalapon	methazole (Probe®)	***tralkoxydim (Achieve 40DG or 80DG)***
[22]dicamba (Banvel®)	[8]metolachlor	tribuphos (Folex, 6EC)
dichlobenil (Casoron®)	[12]metolachlor-s	[9]trifluralin
diflufenzopyr (Distinct™)	metribuzin (Lexone®, Sencor®)	
[20]dimethenamid	monuron	
diquat		